AFML-TR-70-27

USER APPRAISAL AND COST ANALYSIS OF THE AEROSPACE MATERIALS INFORMATION CENTER

F. L. SCHEFFLER

J. F. MARCH

University of Dayton Research Institute
Dayton, Ohio

TECHNICAL REPORT AFML-TR-70-27

MARCH 1970

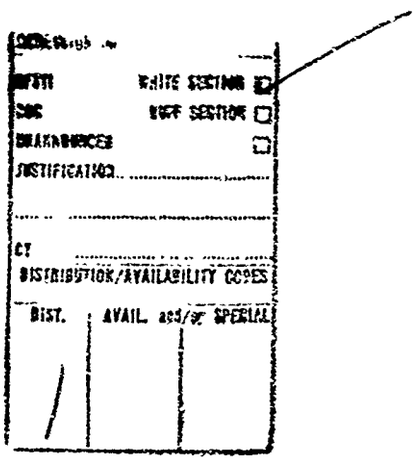
AIR FORCE MATERIALS LABORATORY
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

104

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This document has been approved for public release and sale; its distribution is unlimited.



Copies of this report should not be returned unless return is required by security considerations, contractual obligations. or notice on a specific document.

600 - April 1970 - CO455 - 117-2569

USER APPRAISAL AND COST ANALYSIS OF THE AEROSPACE MATERIALS INFORMATION CENTER

F. L. SCHEFFLER

J. F. MARCH

FOREWORD

This report was prepared by the University of Dayton Research Institute, Dayton, Ohio under Air Force Contract AF 33(615)-3389 and Air Force Contract F33615-69-C-1128. The work described herein was accomplished under Project 7381 "Materials Application" and Task No. 738103 "Materials Information Development, Collection and Processing." The effort was administered under the direction of the Materials Information Branch, Materials Support Division, Air Force Materials Laboratory with H. B. Thompson, MAAM, as project monitor.

This is a final summary report and covers the work accomplished from 1 December 1968 through 30 November 1969.

The authors acknowledge the efforts and contributions of Eugene R. Egan, Howard H. Schumacher, Jr., Tom R. Featheringham, Kathleen M. Keller, George J. Pacinda and Arietta C. Bailey. The conscientious efforts of a number of students in performing the indexing of technical documents is gratefully acknowledged. Major R. W. Shellman provided an analysis of the standard AMIC search evaluation forms.

This report was submitted by the authors January 1970.

This technical report has been reviewed and is approved.

Edward Dugger
Chief, Materials Information Branch
Materials Support Division
Air Force Materials Laboratory

ABSTRACT

An evaluation study was performed for the Aerospace Materials Information Center (AMIC) document retrieval system. Both system performance and economic criteria were established. Analysis of responses indicated that the AMIC system compares favorably with other information centers with regard to providing pertinent materials with a sufficiently rapid response. Results showed a wide interest in special types of documents as well as the technical reports. State-of-the-art, symposium proceedings, bibliographies, handbooks, trade literature and computer programs were indicated as being of high interest. The respondents indicated a fairly high dependence on information services, both within their own organization and outside information services. Cost figures for the past four years show that by far the major cost item is the input of documents into the system. The average cost per document including all clerical and professional effort and overhead has averaged about $10 per item. The cost of searches has varied from $33 to $49 per search including computer time, professional time and clerical time and overhead. Much of the variation in cost can be attributed to the degree of batching of searches. Certain modifications were incorporated into the AMIC system, primarily in response to the respondents to the evaluation form.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES AND TABLES

Section I

INTRODUCTION

The Information Systems Section of the University of Dayton Research Institute (UDRI) has established and presently maintains and operates a document retrieval system in support of the Aerospace Materials Information Center (AMIC). The document retrieval system operated by the University of Dayton contains approximately 45,000 documents concerning materials research and development with new accessions being made continually. The establishment, modification and operation of the document retrieval system are described in the following reports: RTD-TDR-63-4263 (AD 428 423)[1], AFML-TR-65-20 (AD 613 301)[2], AFML-TR-66-36 (AD 633 614)[3], AFML-TR-66-391 (AD 651 039)[4], AFML-TR-67-379 (AD 666 462)[5] and AFML-TR-68-367 (AD 686 804)[6]. The present report describes the work performed from December 1968 to December 1969.

The AMIC document retrieval system has been in operation with retrospective search capabilities since 1963. The purpose of the AMIC document retrieval system is to provide scientific and technical information to qualified requestors in a timely and efficient manner. The information is supplied in the form of abstracts of documents pertinent to the search request; these abstract forms also contain complete bibliographic information including AMIC access number, DDC AD number or NASA N number, generating agency, report number, title, author, contract number (if applicable), contractor (if applicable), sponsoring agency, project monitor (if applicable) and date of issue of the document. The documents themselves, in the form of microfiche are available from the AFML Library on loan to the local requestor, or for permanent retention by the requestor within the lab. However, abstracts of the documents are provided to all requestors. Pertinent bibliographic information sufficient for acquisition of the actual document from DDC, etc., is supplied with the abstracts.

The AMIC document retrieval system is primarily concerned with the materials aspect of technical documents. Because of the concentration on materials, retrieval capabilities from a materials standpoint are very comprehensive. Retrieval can be very specific, as, for example, all information on the alloy Aluminum 2024-T6, or retrieval could be as general as high temperature fatigue of all metals and alloys. Similarly, one could request information on boron reinforced Epon epoxy composites, or one could ask for aircraft structural applications of any composite material.

Searches encompassing the entire range of materials are regularly run by the UDRI in response to requests both from the AFML and DOD contractors. To ensure that the requestor receives abstracts which are relevant to the request, all abstracts and index cards retrieved are screened by content to assess their relative pertinence to the originally stated request. As

part of the normal operations of the AMIC a standard evaluation form is submetted with the search results to provide an opportunity for feedback from the requestors. The evaluation form is shown in Figure 1.

R. J. Penner, in an article in the Journal of the American Society for Information Science, states that requestor feedback is an essential practice in the upkeep of an information system: "One of the major problems in the field of information services is the task of assessing the efficiency and effectiveness of various systems, manual or 'automatic'. The problem may be attacked from the document analysis angle (efforts to establish evaluation criteria by means of recall and pertinence ratios). However, the final criterion in all these measurements is still the subjective evaluation by the user."[7]

An estimated 30% of the AMIC evaluation forms are returned. From a review of these completed and returned AMIC search evaluation forms, it appeared that the AMIC system indeed has been providing useful services to the users of the system. However, it was felt that a far more comprehensive evaluation by the users as well as a study of the user population would provide an assessment of the usefulness and quality of present services, and would present an opportunity for more direct feedback than is normally provided by the standard evaluation forms.

Section II

EVALUATION OF THE AMIC SYSTEM

1. EVALUATION CRITERIA

a. Satisfying Users' Needs

There is definite need for any information system to be evaluated regarding its performance both from the standpoint of fulfilling its primary mission of serving the information needs of the users of the system and from the standpoint of improving its efficiency in carrying out the serving of these needs. Furthermore, any evaluation must incorporate a feedback mechanism from the user himself. Problems in obtaining feedback from the user are motivating him to provide it and eliciting feedback which indeed is meaningful and can be reacted to by the system. There are several specific points which should be considered. The relationship of the content and acquisition of new materials to the users' needs must be determined. The services provided to the user should correspond as nearly as possible to the user requirements. Communication links should be established and maintained between the users and the system itself.

b. Economic Criteria

Economic criteria can be used as a guideline to assess the efficiency and effectiveness of an information system. However, economics at best represents only a guideline and not an absolute criterion for ultimately judging the desirability of establishing, maintaining or discontinuing an information center.

A very interesting discussion transpired at the 1969 Annual Meeting of the American Society for Information Science (ASIS) regarding the imposing of user charges for the services provided by information analysis centers.[8] One point of view expressed was that charges should be applied not only to fund the cost of providing information but also to serve as an economic monitor of the usefulness and quality of specific information centers. Thus, only those centers really providing good services would continue, as their funding and survival would be a direct function of the customers' willingness to pay for services rendered.

Another point of view was that information analysis centers represent a new concept and are, to a large extent, experimental in nature. It is unreasonable to expect them to recover costs of operation. A requirement for the centers to impose charges would kill off potentially highly useful

centers before they had a chance to develop their potential. Furthermore, the direct and indirect manpower and accounting costs of collecting charges would be prohibitive, not to mention the nuisance factor involved.

A third point of view was that the costs of providing for the retrieval and dissemination of information including input processing and financial support of information analysis centers should be built into the original research and development (R&D) funding. In a manner somewhat analogous to the allowance in Federal R&D contracts for report preparation costs, an amount of funding should be earmarked for the retrieval and dissemination functions through information centers. A relatively small proportion of R&D funds would be sufficient to support the information centers.

Economic evaluations of information activities are difficult and seldom present a total picture of the operations. The central mechanics of providing the engineer and scientist with information and the purchase costs of that information are usually more attainable than the expense otherwise incurred by the researchers in their acquiring, screening, and evaluating and making use of the data without assistance from a specialized information activity.

Furthermore, the value of information and its impact on the ultimate research performed almost defy mensuration. What, for instance, is the amount of research redundancy due to lacking information? What is the value of having pertinent information prior to the performance of research? What funds are necessary on a continuing basis within a research organization for information services?

The standard search evaluation forms returned from the users give some hint as to cost savings resulting from receipt of timely, pertinent information, but even these returns are not completely reliable taken strictly at face value. As an example, one person contacted indicated no cost savings occurred from the search results, but, as a direct result of the search results, an anticipated work effort was cancelled. Presumably, the work effort otherwise would have been carried out, and probably at a considerable cost.

The Air Force Machinability Data Center (AFMDC) has published some figures on search costs and cost savings resulting from information provided by the AFMDC.[8] The average cost for 1002 inquiries processed during the period of February 1, 1967 to January 1, 1968, is reported as $52.66; an inquiry is defined as either a document search or a data search for a particular machining situation. The costs the previous two years were $47.45 and $45.02 respectively.

The reported costs of inquiry processing approximates $53,000 ($52.66 x 1002) or 30 percent of the total operating costs ($172,784.50 excluding fixed fee). Thirty-five percent of the total costs were for the input activities of document acquisition, evaluation, and data processing; and 8 percent for the system functions of systems analysis, modification, and control. The remaining 27 percent is attributed to data products, handbooks, and annual reports.

In studying the overall costs of an information center, the input and systems costs perhaps should be included in the average cost of processing an inquiry. If so, the $52.66 figure approaches the $125.00 range. However, AFMDC estimates that the dollar value for a set of recommended parameters given in response to one machining situation is a very conservative $800.00 and usually runs into the thousands of dollars; this represents an impressive return on investment.

An important factor to consider in evaluating any information activity on an economic basis is that there is a certain initial "start-up" period. This incubation period is needed to establish the system on an operating level before the user can receive satisfactory service. The service must ultimately prove itself to the user by its performance. The greatest cost is incurred during the initial period when the service rendered is minimal. Once procedures have been established and user needs are starting to be met, an opportunity exists for improvement and expansion of services into other areas. From first-hand experiences and from reports of others, the initial period required to become established and to begin to be accepted by the user population usually is from one to three years, depending on the scope of the information activity. Obviously, an overall economic evaluation of an information center is a function of the state of maturity of the center.

The preceding discussion of economic criteria for evaluating information systems has been presented to point out the many difficulties associated with such economic evaluations. Too often information activities are looked upon as "luxury" items which deserve support in a favorable economic climate but which suffer first and most when funding becomes scarce. It is rarely recognized that eliminating information services may contribute significantly to increasing overall costs in R&D activities.

Economic factors to be presented in this report represent actual cost experiences in the operations of the AMIC document retrieval system. Cost breakdown is given to show relative expenditures in various facets of the operation.

c. Summary

For evaluating the AMIC document retrieval system, the ability of the system to meet the information needs of the users and the variations in costs over a period of time are two primary criteria. It is widely recognized that information services are expensive to maintain. There is considerable controversy today on the mechanism for funding information centers. Although some cost figures are available, it is very difficult to establish the corresponding cost savings effected by providing timely, pertinent information. All too frequently information services have been considered as expensive overhead without taking into account their overall economic and other advantages. The purpose of providing cost figures in this report is simply to give relative costs and reasons for changes as a guideline for determining the efficiency of the AMIC document retrieval system.

2. AN ANALYSIS OF THE STANDARD AMIC SEARCH EVALUATION FORM

An analysis was made of the standard AMIC search evaluation forms (AFML Form 3a - Figure 1) to evaluate not only the performance of a number of information centers but also the effectiveness of the format and content of the form itself. Completed forms were analyzed for the Plastics Technical Evaluation Center (PLASTEC), AMIC, the Thermophysical Properties Research Center (TPRC), the Defense Documentation Center (DDC), DDC searches of DD Form 1498, the Electronic Properties Information Center (EPIC), the Science Information Exchange (SIE), the National Aeronautics and Space Administration (NASA), the Defense Metals Information Center (DMIC), searches of Commerce Business Daily (CBD) items, the Mechanical Properties Data Center (MPDC), the Defense Ceramics Information Center (DCIC), and the Foreign Technology Division (FTD). The primary interest relative to the work reported in this final summary report is in the AMIC results, but it is worthwhile to compare the performance of AMIC with that of other information activities.

Eighty-three completed forms responded to by requestors regarding search items delivered by the AMIC were analyzed. Item A of the AMIC search evaluation form deals with system effectiveness. The number of items sent to the requestor by the AMIC was relatively small. Over 75% of the respondents indicated that fewer than 15 items (abstracts) were sent. Table I shows the comparative numbers of items sent by various information centers. It can be seen from Table I that NASA and DDC usually return more than 50 data items per search request (60% or more).

Figure 1 **AMIC SEARCH EVALUATION**

AMIC Source Evaluation No. _____

Information Source _____

Date Sent _____ Date Returned _____

Number of Information Items Sent _____

A. EFFECTIVENESS OF SYSTEM

1. Relation of material received to question asked.

	Estimated Percent
Close Relation	_____ %
Moderate Relation	_____ %
Remote Relation	_____ %
No Relation	_____ %

2. Material was pertinent and new to me _____ %

B. EFFECT OF MATERIALS RECEIVED

1. Effect on work done.

Changed course of work ☐
Confirmed requirement for proposed work ☐
Indicated some anticipated work was unnecessary ☐
Only effect was time required to check material ☐
Other *(please specify)* ☐

_____

2. Please give estimates of the value of the information received. *(Indicate if negative.)*

$ _____ or _____ Manhours.

C. GENERAL INFORMATION

1. Please identify agency that benefited from this service.

☐ Air Force ☐ Army ☐ Navy ☐ ARPA
☐ AEC ☐ NASA ☐ FAA
☐ Others *(Specify)* _____

2. Response time. ☐ O.K. ☐ Slow ☐ Very slow

3. This service was intended to support

	Yes	No	
Limited War	☐	☐	
Weapon System	☐	☐	Identify Weapon System _____

_____

PLEASE FOLD, STAPLE, AND RETURN (See Other Side)

AFML FORM 30 MAR 67 PREVIOUS EDITION OF THIS FORM MAY BE USED.

TABLE I: NUMBER OF INFORMATION ITEMS SENT

NUMBER OF INFORMATION ITEMS SENT TO REQUESTORS

	Five or Less	5-15	16-30	31-50	More Than 50	Not Stated
PLASTEC	2 29%	2 29%	1 14%	1 14%	1 14%	0 0%
*AMIC	24 29%	38 46%	12 14%	4 5%	2 2%	2 2%
+TPRC	0 0%	0 0%	0 0%	0 0%	0 0%	3 100%
*DDC	1 2%	2 5%	10 24%	4 10%	25 60%	0 0%
*1498	5 10%	17 34%	13 26%	7 14%	8 16%	0 0%
+EPIC	3 60%	1 20%	0 0%	0 0%	1 20%	0 0%
*SIE	16 31%	24 47%	6 12%	2 4%	3 6%	0 0%
*NASA	3 8%	4 11%	5 14%	2 5%	23 62%	0 0%
*DMIC	2 13%	4 27%	2 13%	2 13%	3 20%	2 13%
*CED	12 52%	10 43%	0 0%	1 4%	0 0%	0 0%
+MPDC	2 25%	3 38%	2 25%	1 12%	0 0%	0 0%
+DCIC	3 38%	2 25%	1 12%	1 12%	1 12%	0 0%
FTD	1 11%	1 11%	0 0%	0 0%	6 67%	1 11%
MISCELLANEOUS	1 20%	1 20%	2 40%	1 20%	0 0%	0 0%

NOTES:

(1) Usually the "information item" will be an abstract or a reference.

(2) Sources with more than 10 reports are marked*.

(3) Centers marked with a (+) are part of the AFML information center network.

Regarding the pertinence of the results, the AMIC search evaluation forms provide an opportunity to indicate Close Relation, Moderate Relation, Remote Relation and No Relation by estimated percentages. To show how a large multidisciplinary information center compares with a smaller more specialized center, results are presented from DDC and the AMIC. Table II shows the distribution of responses by percentage ranges for AMIC, while Table III shows the same for DDC. Of the 73 AMIC requestors, 34 (41%) reported that at least 50% of the references forwarded were of close relation to the search topic, while of the 42 DDC requestors, 20 (48%) reported close relation of at least 50% of the references. On the other hand 13 (16%) AMIC requestors reported no relation to DDC's 11 (26%). Thus, as shown in Figure 2, the number of false retrievals is greater for DDC than is the case with the AMIC system. Since the average number of retrievals is greater for DDC than for AMIC, (more than 50 in most cases as compared with 5 to 15 in most cases), one can see that the requestor is required to screen out nonrelevant documents to a greater extent with returns from DDC.

Item B of the AMIC search evaluation form deals with the effect of materials received by the requestor. Most respondents indicated that the returns from the various information centers confirmed the requirement for the proposed work. Very few indicated that the course of the work was changed, but a significant number indicated that some anticipated work was unnecessary, a fact which must contribute to cost savings to the recipient. Question B 2 asks for estimates of the value of the information received in either man-hours or dollars. Very few respondents provided any information regarding this question. Because of the very limited response, it is not considered valid to make inferences about the value to the requestors of the information received. It is difficult to assess meaningfully a dollar or man-hour figure for savings, and there seems to be a reluctance on the part of most R&D personnel even to admit that the information was valuable to them as indicated earlier in Section I b.

Item C of the AMIC search evaluation form requests information on the agency benefiting from the information service provided, the response time, and whether either limited war activities or a specific weapon system were to be supported by the information service. In the great majority of cases, the Air Force was indicated as the benefiting agency. The acceptability of the response time was exceptionally good for all the centers. For the AMIC system, 80% indicated response time was O.K., 8% responded that response time was slow, less than 1% thought response time was very slow and 12% did not answer the question. There is some indication from these results that the response time for the AMIC is somewhat slow compared to other centers in at least a few cases.

Table II: RELEVANCE BREAKDOWN OF SEARCH RESULTS FOR AMIC

	Close	Moderate	Remote	No Relationship
Percentage Range		(Number Responses)		
0 - 9	21	26	38	44
10 - 19	2	9	11	6
20 - 29	12	12	8*	3*
30 - 39	3	7*	4	3
40 - 49	1*	1	3	3
50 - 59	7	6	3	2
60 - 69	3	0	1	1
70 - 79	5	7	3	1
80 - 89	4	1	0	0
90 - 99	15	4	4	9
No answer	10	10	9	13

Table III: RELEVANCE BREAKDOWN OF SEARCH RESULTS FOR DDC

	Close	Moderate	Remote	No Relationship
Percentage Range		(Number Responses)		
0 - 9	13	14	18	17
10 - 19	2	6	12*	3
20 - 29	0	11*	3	1
30 - 39	1	3	3	1*
40 - 49	0*	0	1	2
50 - 59	2	3	0	0
60 - 69	5	0	0	0
70 - 79	5	2	0	0
80 - 89	0	0	0	3
90 - 99	3	0	0	8
No answer	6	3	3	7

* - average % relevance (see figure 2)

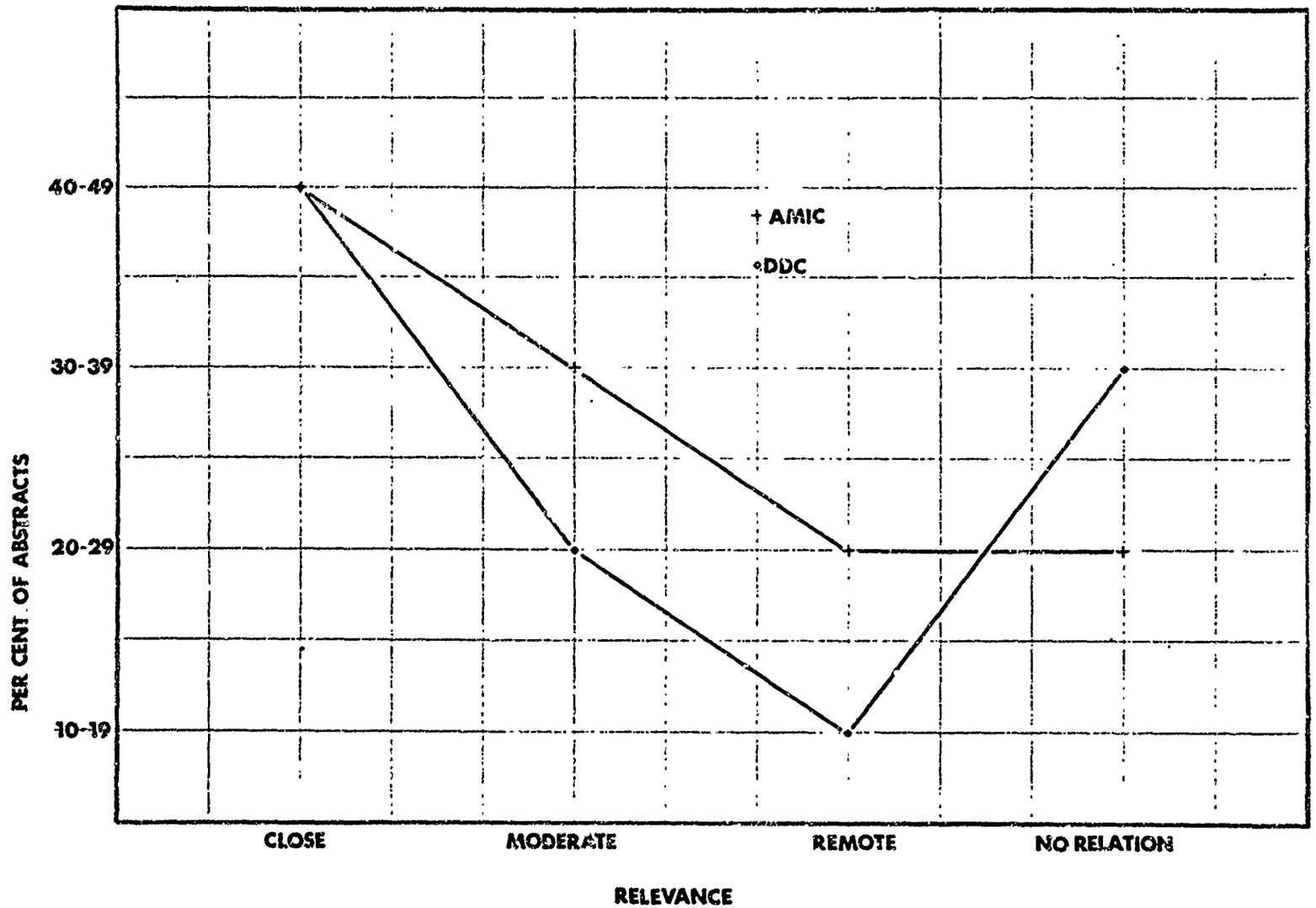


Figure 2 Average Relevance of Search Results

The analysis of the results shows that the performance of the AMIC system regarding system effectiveness, effect of materials received, agency benefited and response time is basically comparable to that of other information systems. The AMIC system appears to provide a relatively high proportion of relevant material (at least comparable with other similar systems) and tends to send fewer nonrelevant documents than most other systems. Response time appeared to be longer for the AMIC at least in some cases than for other information systems.

It was desired by the personnel of the AMIC to obtain a more precise analysis of how this specific system serves the needs of its requestors; it was also highly desired to incorporate modifications as indicated from this more precise analysis to enable the AMIC to serve the needs of the requestors even better. With these considerations, it was decided to formulate a plan for evaluating the AMIC system.

3. THE PLAN FOR EVALUATING THE AMIC SYSTEM

The plan for evaluating the AMIC system was conceived as composed of two parts. The first part is concerned with the ability of the AMIC system to serve the requestors by providing them with the information and information services they need, and the second part is concerned with the efficiency of the system as indicated by the costs involved in operating the system with particular emphasis on the change in costs over a period of time and the reasons for the cost changes.

a. Requestors

To serve the needs of requestors, it was determined that it would be useful to identify certain characteristics of the user population including type of work, subject matter of work, information seeking behavior, etc. Also it was desired to elicit from the requestors the types of documents of greatest interest, the document sources of most value, documents which were most difficult to obtain access to and any special problems with regard to the document collection itself or to the operations of the AMIC system. Finally, a verification of the results of the AMIC search evaluation form regarding adequacy of response time and relevance of search results to the requests was desired. An assessment of familiarity with Selective Dissemination of Information (SDI) and its anticipated helpfulness was determined to be useful. SDI profiles were explained to those expressing an interest, and responses were used to guide the establishment of an in-house SDI program. The evaluation form designed is shown in Figure 3.

FIGURE 3. EVALUATION FORM

DATE_____

AN EVALUATION STUDY OF THE
AEROSPACE MATERIALS INFORMATION CENTER

1. a. Name of Respondent _____

   b. Organization _____

   c. Most recent search request _____

2. a. How did you learn of the information retrieval services of the AMIC?

   _____

   b. Was your request(s) for information direct or through library, information center or administrative facilities of your organization? (AFML personnel directing their requests through MAAM would be considered to be using their information center)

   Direct _____ Through Information center, library, etc._____

3. How would you describe your work or research?

   Basic Research _____
   Applied Development/Technical _____
   Evaluation/Testing _____
   Management _____
   Librarian/Information Specialist _____

   Comment: _____

4. What is the subject area or discipline of your work?

   _____

   _____

   _____

FIGURE 3. EVALUATION FORM (CONT'D)

5. Which of the following categories of documents might provide information of interest or use to you in your work? Please add comments or qualifications if helpful.

a.	AFML in-house	_____ _____
	AFML sponsored	_____ _____
	Other USAF sponsored	_____ _____
	Other DOD sponsored	_____ _____
	Foreign Translation (FTD)	_____ _____
	NASA sponsored	_____ _____
	AEC sponsored	_____ _____
	Other	_____ _____
b.	Theoretical	_____ _____
	Evaluation/Testing	_____ _____
	Applications/Manufacturing	_____ _____
	In-service Experience	_____ _____
	Applied Research & Development	_____ _____
c.	Technical Report	_____ _____
	Bibliography	_____ _____
	Symposium proceedings	_____ _____
	State-of-the-Art	_____ _____
	Handbook	_____ _____
	Trade Literature	_____ _____
	Computer Programs	_____ _____

6. Were you aware that the actual documents are available corresponding to abstracts sent from the AFML Library on loan?

Yes _____ No _____

Hard copy or microfiche documents can usually be obtained for permanent retention from the Defense Documentation Center (DDC) or the Clearinghouse for Scientific and Technical Information (CFSTI). AD numbers are provided on the abstracts you receive where available for ordering purposes.

7. Please help us in evaluating our services:

a. Were the results of the search(es) returned to you fast enough?

Yes _____ No _____

How long from query initiation to receipt of results? _____

Is there usually some minimum time required between query initiation to receipt of results? Yes _____ No _____ Approximately what is this time factor? _____

b. Was the information retrieved pertinent; did you receive what was requested? Yes _____ No _____

Comment _____

FIGURE 3. EVALUATION FORM (CONT'D)

8. What other sources of information or data do you use?

   a. Abstract/announcement services e.g. Chemical Abstracts, NASA SCAN DDC Group Announcement Bulletin (GAB), etc.

   _____

   _____

   b. Information Analysis Centers; such as TPRC, PLASTEC, DMIC, AMIC, etc.

   _____

   _____

   c. Corporation (agency) library services, review reports, information center or STINFO OFFICE.

   _____

   _____

   d. Do you personally regularly perform literature searches from the library, personal document collection, etc.

   Yes _____ No _____

   e. Do you participate in any type of Selective Dissemination of Information (SDI) service e.g. ISI, POST-J, ECOM SDI, CA Condensates, etc.

   Yes _____ No _____

   Would such a service be/or is such a service valuable to you?

Essential for my work	_____
Very useful	_____
Moderately helpful	_____
Only of fring: usefulness	_____
No benefit	_____

9. General Comments: _____

_____

Since your last search, the AMIC system has received many new acquisitions and has been considerably updated and expanded with more flexible search strategy capabilities, additional terminology, state-of-the-art, handbook, symposia, bibliography documents and other improvements.

FIGURE 3. EVALUATION FORM

10. Suggestions for improvements in the AMIC system, particularly as might apply to your fields of interest of your research requirements:

_____

_____

_____

Thank you for your time and cooperation.

Please mail this form to:

Mr. Frederic L. Scheffler
Room 453 E/R Building
University of Dayton
Dayton, Ohio 45409

The methodology employed in obtaining responses was to make a number of telephone calls to a selected representative cross-section of requestors with the information being recorded on the forms during the telephone conversation. By this technique the adequacy of the form could be checked, and the person contacted could interact directly with the questioner. A number of helpful ideas were obtained by this method, and certain modifications were incorporated in the form to be submitted by mail. Figure 3 represents the modified form.

Approximately four hundred requestors were selected from those who had submitted one or more requests in the period 1967-1969. The requestors represented AFML personnel, personnel from other Government agencies, both DOD and other branches, UDRI requestors, and requestors from industrial organizations who are DOD contractors. Twenty-nine telephone contacts as described above were made. The forms with return envelopes were mailed out to 340 requestors. Follow-up letters and additional forms were sent out to those requestors who had not responded within six to eight weeks of the original mailing. Statistical data regarding the returns were accumulated.

b. Economic considerations

An indication of the efficiency of the AMIC document retrieval system is given by examining the costs of operations and the work accomplished for a given cost. The primary cost involves salaries, wages and overhead. The cost of equipment, equipment rental, office supplies, materials and services etc. represent an important but relatively small part of the costs of the AMIC operation. Time spent by personnel in performing the work associated with various AMIC operations has been distributed by task numbers and reported in the three previous annual summary reports by percentage of time for each task number. In all cases the major portion of time and consequently the cost has been spent, as would be expected, on input operations. A significant but surprisingly small portion of time has gone into search operations. The portion of time spent on updating and thesaurus development has varied rather widely depending, in part, on the extent of the thesaurus revision and, in part, on the efficiency with which the revision was made. Special assignments in support of the Materials Information Branch but not directly related to the operation of the AMIC document retrieval system have accounted for a significant amount of time.

In examining the cost figures it appeared that the costs for salaries, wages and overhead would represent a good approximation of the costs for the various activities. The costs to be examined closely are the input costs including student and professional time for indexing and associated clerical processing and record keeping, and the search costs, including professional time in formulating search strategy, search run costs, search screening and

associated clerical costs. Also a breakdown of costs for a typical contract year will be presented.

4. RESULTS

a. Requestors

The requestors represented many elements of research and development personnel and a number of organizations, both Government and non-Government. Of the requestors contacted, approximately half were from the AFML and the other half represented all other requestor organizations. Of the 369 telephone calls and letters sent out, 182 returns were forthcoming for a return rate of 50%. A number of contacts could not be made due to death, transfer, retirement, etc. For purposes of analyzing the requestors and the performance of the AMIC system in meeting their needs, AFML and non-AFML requestors were treated in two separate groups. One hundred and two returns were received or responded to by telephone from the AFML and eighty returns came back from the other organizations. The distribution of requestors by organization is given in Table IV.

Composite results from responses to the evaluation form which could be readily quantified are given in Table V. The responses to Question 4 dealing with the subject area of work are provided in Appendix I. The large majority of respondents indicated that they are engaged in applied development and technology. A significant number are concerned with testing and evaluation. Surprisingly, fewer requestors are engaged in basic research than would have been expected, especially for non-AFML organizations. It can be inferred from these results that for the AMIC document collection, particular emphasis should be placed on documents dealing with applied research aspects of aerospace materials. Perhaps further efforts should be made to make basic research people more aware of the AMIC systems and its service.

The subject areas of most interest were determined by assigning one or more AMIC subject categories as described in detail in Appendix IV to each respondent as indicated by his response to Question 4. Table VI indicates the distribution by subject category. These data are presented graphically in Figure 4. These results indicate strongly the interest of the requestors in engineering, metallurgy and chemistry. A number of other areas are also of significant interest. These results have implications with regard to the acquisition of new documents and also provide considerations for thesaurus and active vocabulary terms to insure that the document collection reflects the needs of the users of the AMIC system.

TABLE IV RESPONDENTS BY ORGANIZATION

AFML

- MAA Materials Support Division
  - MAAA Aeronautical Systems Support Branch
  - MAAE Materials Engineering Branch
  - MAAM Materials Information Branch
  - MAAS Space and Missiles Systems Support Branch
- MAC Advanced Filaments and Composite Division
- MAM Metals and Ceramics Division
  - MAMC Ceramics and Graphites Branch
  - MAMD Strength and Dynamics Branch
  - MAMN Processing and Nondestructive Testing Branch
  - MAMP Metals Branch
  - MAMS Advanced Metallurgical Studies Branch
- MAN Nonmetallic Materials Division
  - MANC Plastics and Composites Branch
  - MANE Elastomers and Coatings Branch
  - MANF Fibrous Materials Branch
  - MANL Fluid and Lubricating Materials Branch
  - MANP Polymers Branch
- MAT Manufacturing Technology Division
  - MATE Electronics Branch
  - MATF Fabrication Branch
  - MATP Materials Processing Branch
- MAY Materials Physics Division
  - MAYA Analytical Branch
  - MAYE Electromagnetic Materials Branch
  - MAYH Exploratory Studies Branch
  - MAYT Thermal and Chemical Physics Branch

TABLE IV (CONTINUED)

WPAFB (not AFML)

1. Aeronautical Systems Division
2. Aeropropulsion Laboratory
3. Aerospace Research Laboratory
4. Avionics Laboratory
5. Cataloging Office (ASD)
6. Deputy for Systems and Equipment Management (ASD)
7. Flight Dynamics Laboratory
8. Logistics Command
9. Support Services Office (ASD)

Government Agencies

1. Air Force Civil Engineering Center
2. Dept. of Energy, Mines and Resources of Canada
3. National Aeronautics and Space Administration (NASA)
4. U.S. Naval Ordnance Laboratory
5. National Security Agency
6. Naval Systems Command Headquarters
7. Plastics Technology Evaluation Center (PLASTEC)
8. Tinker Air Force Base
9. U.S. Dept. of Interior-Bureau of Mines

Universities and Industry

1. Aerojet General Corporation
2. Aeroquip Corporation
3. Allis Chalmers
4. Aluminum Industries
5. Babcock and Wilcox Research Center
6. Bendix Corporation
7. Boeing Company
8. Brunswick Corporation

TABLE IV (CONTINUED)

(Universities and Industry Continued)

Universities and Industry

9. Canadian Westinghouse
10. Clary Corporation
11. Collins Radio Company
12. Dexter, C.H. & Sons
13. Esso Research
14. Fairchild-Hiller
15. Goerz Optical Company
16. General Dynamics Corporation
17. General Electric Company
18. Hercules, Incorporated
19. North Carolina State University
20. Olin Corporation
21. Raytheon
22. Richards Industries, Inc. -Jordan Valves Division
23. Scoto, Incorporated
24. United Aircraft-Hamilton-Standard Division
25. University of Dayton
26. University of California
27. University of Utah
28. University of Vermont

TABLE V. COMPOSITE RESULTS FROM EVALUATION FORMS (See Evaluation Form - Fig. 3)

Question No.		AFAL	OTHER
2.b.	How was your request forwarded?		
	Direct	18%	50%
	Through Infor. Ctr. etc.	82%	50%
3.	How would you describe your work?		
	Basic Research	18%	16%
	Applied Development/Technical	58%	48%
	Evaluation/testing	12%	16%
	Management	9%	4%
	Librarian/Information Specialist	3%	14%
6.	Were you aware that documents are available on loan?		
	Yes	85%	63%
	No	11%	36%
7.a.	Were the results returned to you fast enough?		
	Yes	93%	79%
	No	7%	8%
	No Answer	1%	13%
	Response Time	3wks.	4wks.
	Is there a time factor for receiving search results?		
	Yes	40%	45%
	No	42%	36%
	No Answer	18%	19%
	Time Factor	3wks.	3wks
7.b.	Was the information sent pertinent?		
	Yes	64%	65%
	No	14%	14%
	No Answer	22%	21%
	Comment		
	Nothing New	9%	4%
	Very Helpful	2%	4%
8.d.	Do you personally regularly perform literature searches?		
	Yes	43%	51%
	No	50%	48%
	No Answer	7%	1%
8.e.	Do you participate in an SDI service?		
	Yes	15%	15%
	No	77%	74%
	No Answer	8%	11%
	What is or would be the value of such a service?		
	Essential for my work	6%	7%
	Very Useful	29%	32%
	Moderately helpful	26%	26%
	Only of fringe usefulness	18%	17%
	No benefit	5%	8%
	No answer	16%	10%
	What is SDI?	0%	5%

TABLE VI DISTRIBUTION OF AREA OF INTEREST BY SUBJECT CATEGORY

Category		No. of Requestors*
01	Aeronautics	8
02	Geo-Sciences	1
03	Chemistry	22
04	Computers Electronics	10
05	Adhesives	5
06	Seals	1
07	Ceramics, Graphites	9
08	Coatings-plastic, elastomers	12
09	Composites	13
10	Fibers, textiles, cloth	6
11	Metallurgy	28
12	Lubricants, oils	5
13	Polymers, Plastic	8
14	Elastomers, Rubber	7
15	Cleaning compds.	0
16	Wood and Paper Products	1
17	Fuels, Propellants	7
18	Mechanical Engineering-Manuf, Tech.	37
19	Methods and Testing apparatus	18
20	Nuclear Science, Radiation	6
21	Physics	13
32	Space, Missiles	14

*Some in more than one category.

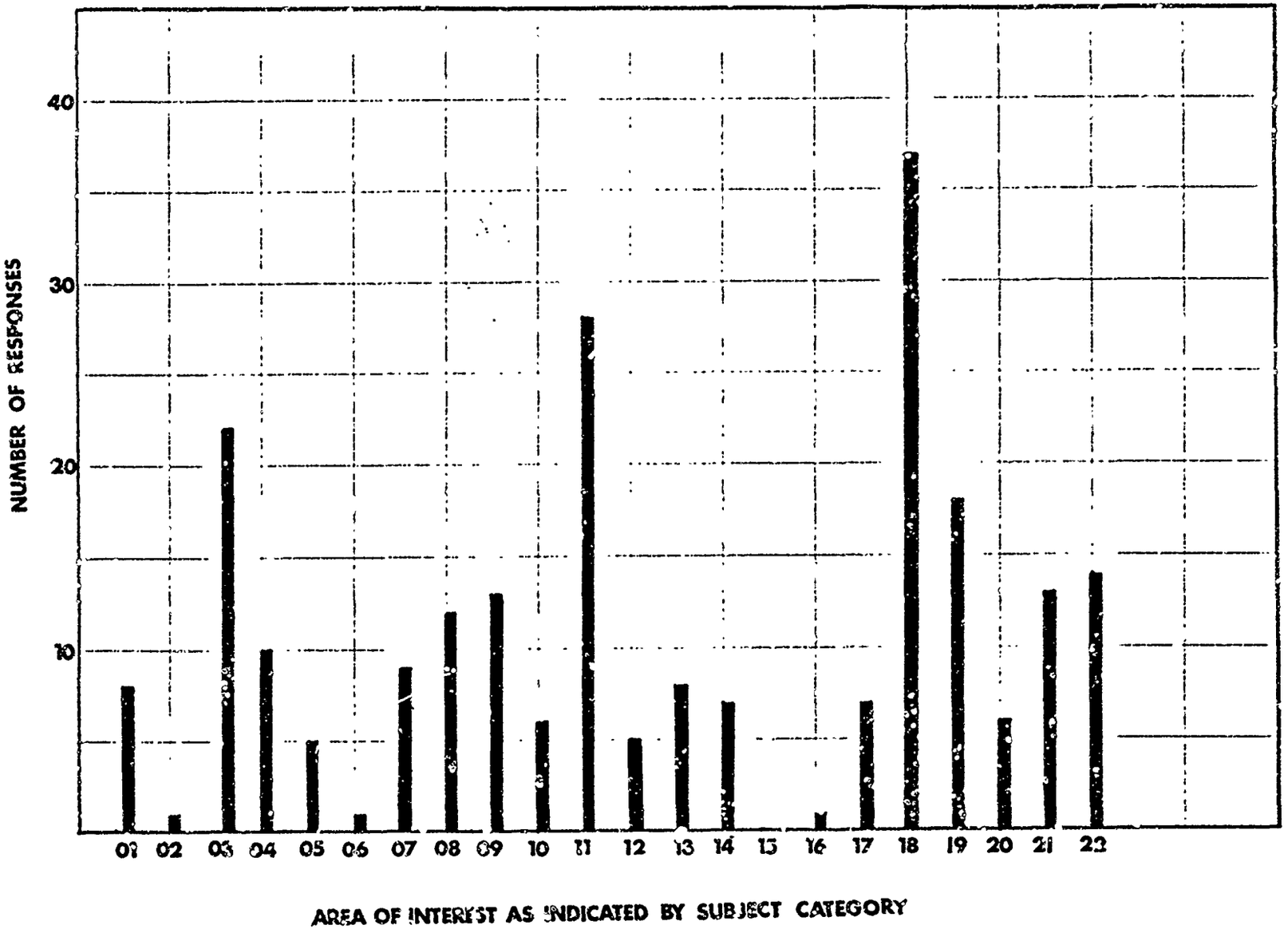


Figure 4 - Area of Interest as Indicated by Subject Category

The types of documents which are of most interest to the respondents were determined from Question 5 and are shown in Table VII. The types of reports desired by generating or sponsoring agency are very evenly distributed If one combines AFML sponsored and AFML in-house, about 30% of the reports desired can be accounted for. The AFML Library is on distribution lists for all AFML generated and sponsored reports, so this source should be complete. By type of work activity, applied research and development is the most frequently cited, but there is very even distribution of responses among all the types. Although technical reports are most often listed, there was a surprisingly strong indication that symposium proceedings, state-of-the-art reports, bibliographies, handbooks, trade literature and computer programs are also desired. Recently these types of documents except trade literature have been indexed and added to the system in addition to technical reports, although the indexing is not as detailed as for technical reports. About 25% of the respondents indicated that all the listed types of reports in all listed categories are of interest.

A listing of each item without regard to category was prepared and ordered according to the number of responses per item. This list is shown in Table VIII. From this listing it can be seen that state-of-the-art and symposium proceedings are very much desired by the requestors. Applications/manufacturing and applied research and development reports are considered very useful by the requestors.

The information sources utilized by the requestors were obtained from Question 8. A number of sources were listed including abstract/announcement services, information dissemination centers, library services, personal library collections, personal contact and journal literature. A listing of the twenty-five most often cited information sources is given in Table IX. From these data one can see that there is a fairly great dependence on information dissemination centers and current awareness activities. Most requestors indicated reliance on internal information services such as a STINFO office or corporate information activity for their information needs. This is further underscored by the fact that half or fewer of the respondents indicated that they regularly perform their own literature searching.

From responses to Question 8d and 8e it was learned that only about 15% of both AFML and other respondents currently participate in an SDI service. Yet over 60% indicate that such a service would be at least moderately useful in their work. These data, especially from AFML, were particularly valuable in initiating an SDI service for AFML personnel as reported in Section 4. The responses show a very strong interest in SDI services, and yet relatively little was being done in this area.

TABLE VII TYPES OF DOCUMENTS DESIRED

BY SPONSORING OR GENERATING AGENCY

NASA sponsored	16%
AFML sponsored	16%
Other DOD sponsored	14%
AFML In-House	14%
USAF sponsored (not AFML)	13%
FTD translations	13%
AEC sponsored	9%
Other	5%

BY TYPE OF WORK ACTIVITY

Applied R & D	26%
Evaluation/Testing	22%
Applications/Manufacturing	21%
In-service Experience	16%
Theoretical	15%

BY TYPE OF DOCUMENT

Technical Report	19%
Symposium proceedings	18%
State-of-the-Art	18%
Bibliography	14%
Handbook	13%
Trade Literature	11%
Computer Programs	7%

TABLE VIII Categories of Useful Documents in Descending Order.

AFML		OTHER	
Category	No. of responses*	Category	No. of responses
State-of-the-Art	57	Tech. Reports	48
Tech. Reports	56	Applications/Manufacturing	44
Applied R&D	55	Symposium	44
Symposium	54	State-of-the-Art	43
Other DOD Sponsored	48	Evaluation/testing	41
NASA Sponsored	47	AFML Sponsored	39
Applications/Manufacturing	44	Applied R&D	39
AFML Sponsored	39	NASA Sponsored	36
Bibliography	36	Bibliography	33
Other USAF Sponsored	35	AFML in-house	30
Evaluation/testing	33	Other USAF Sponsored	29
Handbook	33	Handbook	28
Trade Literature	33	Trade Literature	25
AFML in-house	30	In-service Experience	24
FTD translations	26	Other DOD Sponsored	23
In-service Experience	26	Theoretical	19
Theoretical	25	FTD translation	18
AEC Sponsored	13	AEC Sponsored	16
Computer Programs	10	Computer Programs	12
	697		500

*Usually more than one category of interest checked.

TABLE IX INFORMATION SOURCES OF REQUESTORS

	SOURCE	No. of responses AFML	OTHER ORGANIZATIONS
1.	Defense Metals Information Center (DMIC)	44	24
2.	Chemical Abstracts (CA)	32	23
3.	DDC Group Announcement Bulletin (GAB)	22	15
4.	NASA SCAN	20	16
5.	STINFO or Corporate information activity	20	12
6.	Technical reports	17	7
7.	AMIC	16	10
8.	PLASTEC	15	11
9.	Libraries	8	13
10.	Abstract journals (other than (CA) or NASA STAR)	8	8
11.	Thermophysical properties research center (TPRC)	6	7
12.	DDC literature search	5	7
13.	Foreign Technology Division (FTD)	5	1
14.	Personal Contact	4	0
15.	Journals	3	5
16.	NASA literature search	3	6
17.	NASA STAR	3	7
18.	Defense Ceramics Information Center (DCIC)	2	6
19.	Mechanical Properties Data Center (MPDC)	2	4
20.	Electronic Properties Information Center (EPIC)	2	2
21.	Personal library	1	2
22.	Clearinghouse CAST FAST	0	5
23.	Air Force Mechinability Data Center (AFMDC)	0	4
24.	Quicksort reinforced plastics system	0	2
25.	National Bureau of Standards	0	1

Although an opportunity was provided for comments and suggestions for improvements, only about 15% of the respondents returned any comments. Nonetheless, a number of useful items were mentioned. In summary, several comments were received on the inadequate quality of abstracts from a reproduced copy standpoint Faster service was desired by several respondents. Concerning the content of the material returned more recent and more specific material were indicated as being desired by several individuals. A number of respondents desired to know more about the AMIC both organizationally and with regard to its services and capabilities. A better coordination of information services and information centers providing the services was suggested.

Specific comments received indicated desires for classified material, information on foreign alloy designations and their corresponding compositions, inclusion of journal literature, inclusion of Air Force sponsored theses, a referral service to an expert in the area of a particular search request, access to patent literature and participation in the AMIC SDI service.

b. Economic considerations

Since 1966, task numbers have been assigned to various AMIC document retrieval system activities to indicate the distribution of effort. The distribution of professional and clerical time by task number for the contract year 1969 (1 DEC 68 - 30 NOV 69) is given in Table XIII in Section III of this report; the task number definitions are provided in Figure 10. The dollar amounts for the past four years expended on the various task numbers is shown in Figure 5. These amounts account for salaries, wages and overhead.

It can be seen from Figure 5 that by far the major effort goes into Task 02 which includes all costs of document input including clerical processing and record keeping, indexing and review indexing. Starting in contract year 1967, all keypunching has been performed by AMIC clerical personnel; prior to this time, keypunching was performed by the Data Services Section, and these costs are not reflected in the salaries, wages and overhead for Contract Year 1966. It is of interest to look at the unit cost of processing documents into the system. Figure 6 shows the cost per document for each of the four years as determined from salaries, wages and overhead divided by the number of documents processed in a contract year. From this figure it can be seen that the cost per document has remained almost the same over the four years at about $10 per item entered into the system. Penner quotes the comparable cost of indexing a document in an information system described by Montague in American Documentation as $15.[7] No adjustment for inflation was made in these figures. In a somewhat analogous situation it has been reported that the average cost of original cataloging of a book into a conventional library collection is about $7.30.[10]

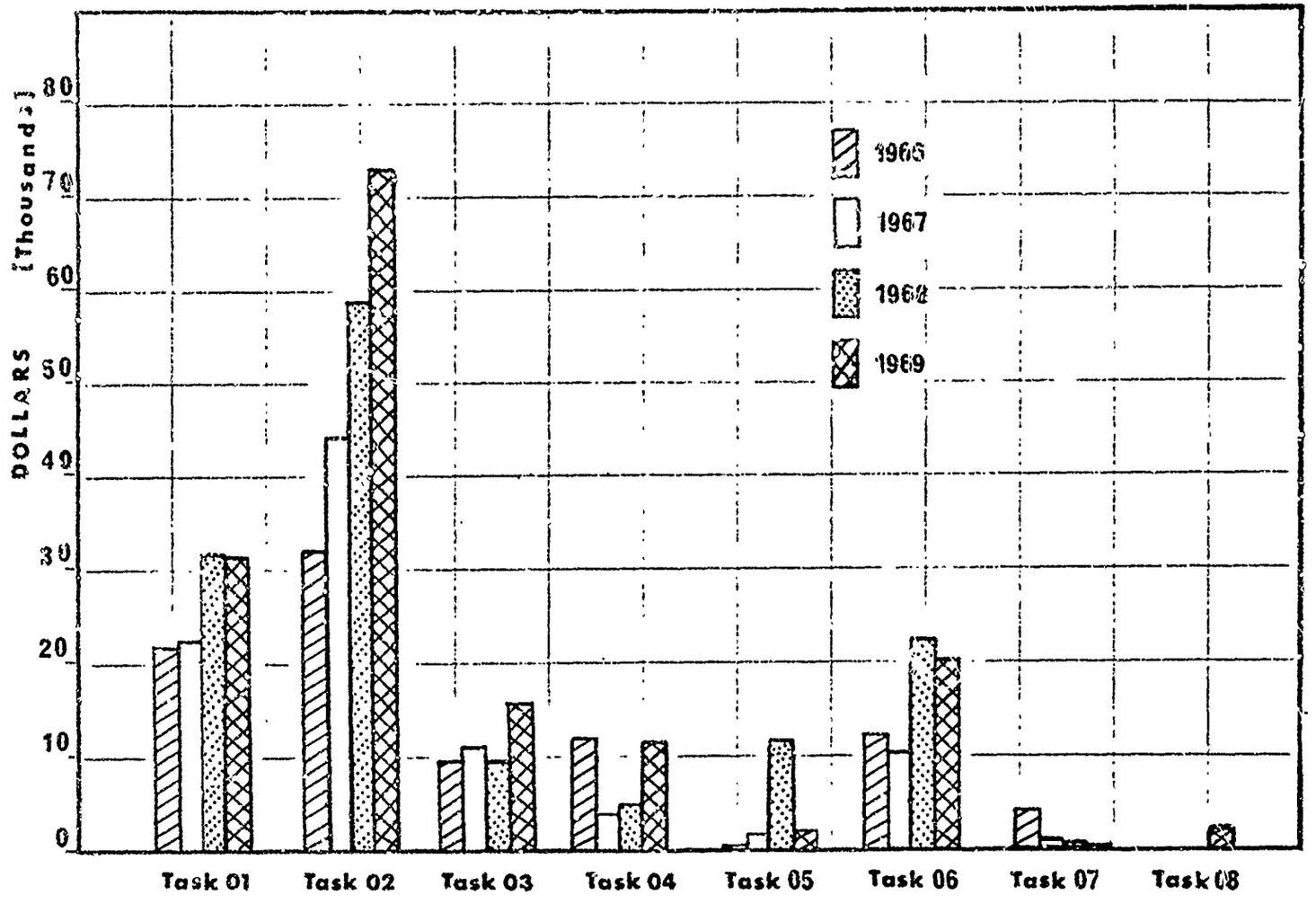


Figure 5 Cost Distribution by Task Number

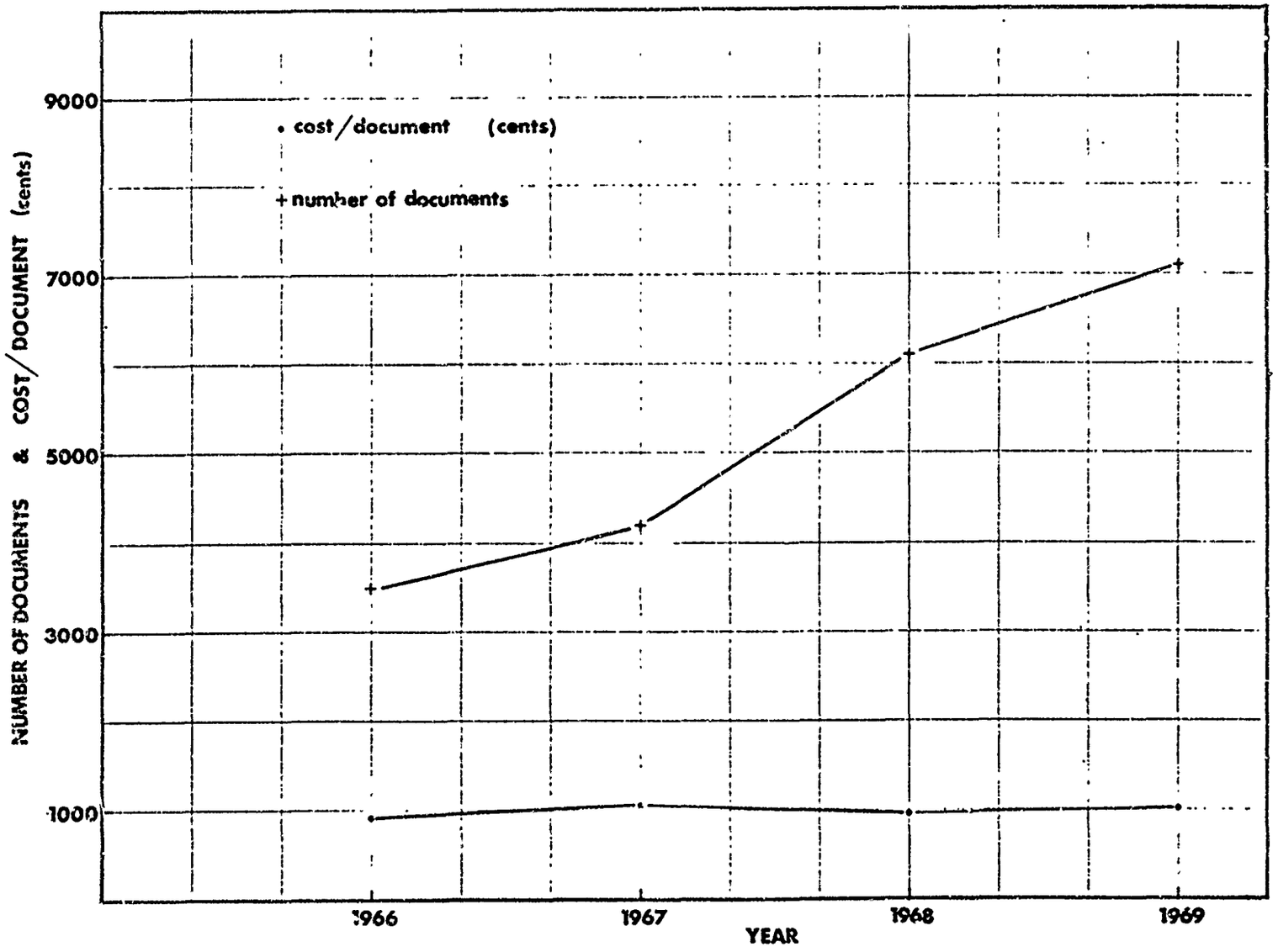


Figure 6 Cost per Document and Number of Documents Indexed 1966-1969

During this time period the use of students for indexing has increased and the use of professionals for original indexing has decreased. The cost of student indexers is less, but their work requires review by professionals, whereas original professional indexing requires much less review. The increased use of students, although it has not decreased the cost per item, has permitted a greater number of documents to be indexed in a contract year.

The cost of performing searches encompasses the cost for maintaining clerical records, the cost of search strategy formulation by an information specialist, the screening of the search results by an information specialist, and the computer cost for running the search. The average cost per search for the last four years is shown in Figure 7. It is a requirement that before a new program is initiated by the AFML, a search must be run by the AMIC to ensure that the new program does not duplicate previously performed work. These searches usually arrive in large batches, and the efficiency of processing batches of searches is greater than processing searches one or a few at a time both from a computer standpoint and from the standpoint of professional and clerical time expended. Because of the relatively large number of such searches in 1966 and the relatively small number since then, the cost per search figure was significantly lower for that year. The effect of batching of searches on the computer cost per search is shown in Figure 8. There is some variation within the batching due to variations of length of search strategies and the number of retrievals obtained. However, as a general trend, it can be seen that batching of searches as much as possible reduces considerably the computer cost per search and, correspondingly, the professional/clerical cost per search goes down with increased batching.

A breakdown of the total operating costs of the AMIC document retrieval system for Contract Year 1968 is shown in Table X. Approximately 88% of the operating costs can be attributed to salaries, wages and overhead.

5. MODIFICATION OF THE AMIC DOCUMENT RETRIEVAL SYSTEM

In response to analysis of the results of the evaluation of the AMIC document retrieval system certain modifications were incorporated in procedures and in types of materials input into the system. Descriptive materials were prepared to be submitted to search requestors with the first request serviced for an individual. One form explains how the requestor should evaluate the abstracts forwarded to him and indicates that all searches are screened by an information specialist before being returned to the requestor. The other form provides a description of the AMIC both from an

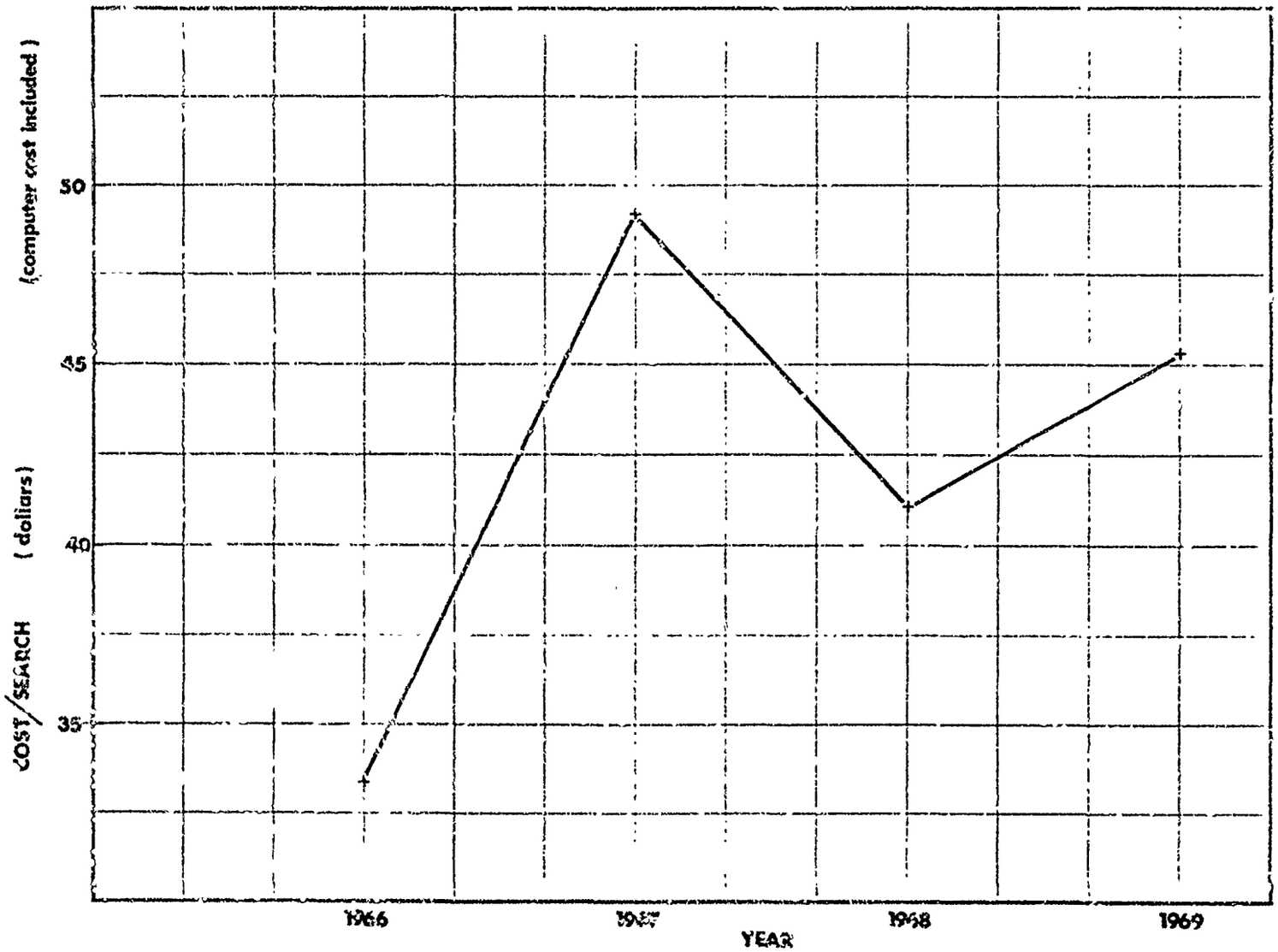


Figure 7 Average Cost per Search 1966-1969

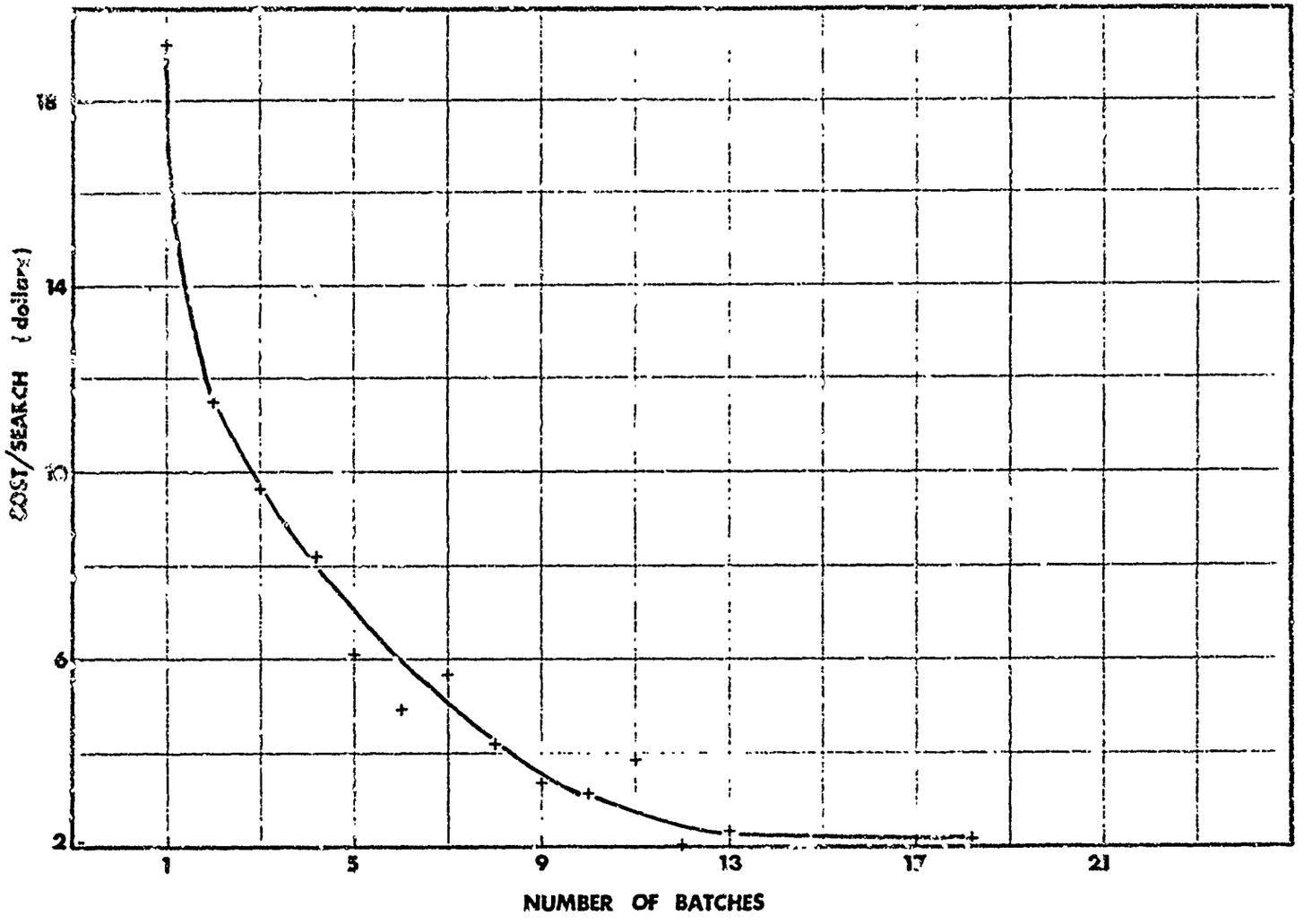


Figure 8 Effect of Batching on Computer Cost per Search

TABLE X

OPERATING COSTS OF THE AMIC DOCUMENT RETRIEVAL SYSTEM

1 DEC 67 to 30 NOV 68

Operating Costs			Total
Salaries and Wages			
Task 01*	General	$21,100	
Task 02	Input	47,400	
Task 03	Output	7,500	
Task 04	Updating	4,300	
Task 05	Research/Materials Information Bulletin	10,500	
Task 06	Special Projects	13,800	
Task 07	Microfilming	500	
			$105,100
Overhead			$ 32,300
Equipment			3,800
Materials and Services **			8,100
Equipment Rental			3,900
Communications			150
Travel			1,600
TOTAL			$155,850

* See Figure 9 for more detailed breakdown of task numbers.

** Includes subscriptions to Chemical Abstracts, Post-J, Post-P, and CA Condensates, current awareness services.

organizational standpoint and from the standpoint of the services provided and types of documents by subject matter contained in the system. These items are shown in Appendix III.

From comments and suggestions received, certain vocabulary and thesaurus additions were made. In the area of metallurgy, superalloys are now indexed and retrievable with greater specificity. Specific aircraft and space projects are designated individually. Data ranges analogous to the temperature ranges were established for pressure, energy, frequency and wavelength. A more detailed listing of polymers including the naming of specific types of nylon was made.

From the strongly indicated desires of the respondents, special types of reports are being indexed and added to the system. These special types of documents are as follows. bibliographies, symposium proceedings, computer programs, state-of-the-art, handbook, theses, and foreign translations. The indexing of these special documents is not as detailed as is the case with the standard technical report. Usually more general terms i.e. higher generic level terms are employed in such indexing. Trade literature was indicated as being of fairly high interest, but the suitability of including trade literature and the types of trade literature which would be useful are matters as yet unresolved.

Section III

DOCUMENT RETRIEVAL SYSTEM OPERATION

1. INPUT

In addition to handbooks ("H" access numbers) which have been input to the system since the previous reporting period, state-of-the-art documents ("SA" access numbers), symposium proceedings ("S" access numbers) and Bibliographies ("B" access numbers) are being indexed and added to the AMIC document retrieval system on a continuing basis. Also computer programs, theses, foreign translations, AFML in-house and AFML sponsored reports are designated by special vocabulary terms, although the reports themselves are assigned regular access numbers.

The past year has seen a continued increase in the quantity and percentage of documents being received in the form of microfiche. At the present time approximately 90 percent of the documents forwarded to the University for indexing are in the form of microfiche. Because of the acquisition of suitable microfiche handling equipment, little difficulty has been experienced in making the transition from hardcopy form to microfiche form.

During the period covered by this report, 1 DEC 68 through 30 NOV 69, approximately 7100 documents were indexed and processed into the system. Of this number, 112 were handbooks, 215 were state-of-the-art, 134 were bibliographies and 115 were symposium proceedings. The documents were indexed with an average of 20.5 terms per document (exclusive of automatic generic postings) with an average indexing time of 30.5 minutes. Distribution by subject category is shown in Table XIV in Appendix II. There are now approximately 45,000 documents in the AMIC document retrieval system.

2. SEARCHING

A total of 342 technical requests were processed by the Information Systems Section during the report period. This represents an increase of 34% over the previous reporting period. An average of ten abstracts were printed per search for forwarding to the search requestors.

Figure 9 presents the number of search requests processed by the AMIC document retrieval system since 1963 on a contract year basis. The number of requests is shown by total requests, requests from the AFML and requests from organizations from outside the AFML. During the past year, the number of requests from organizations outside the AFML increased only slightly, but the requests from AFML increased significantly.

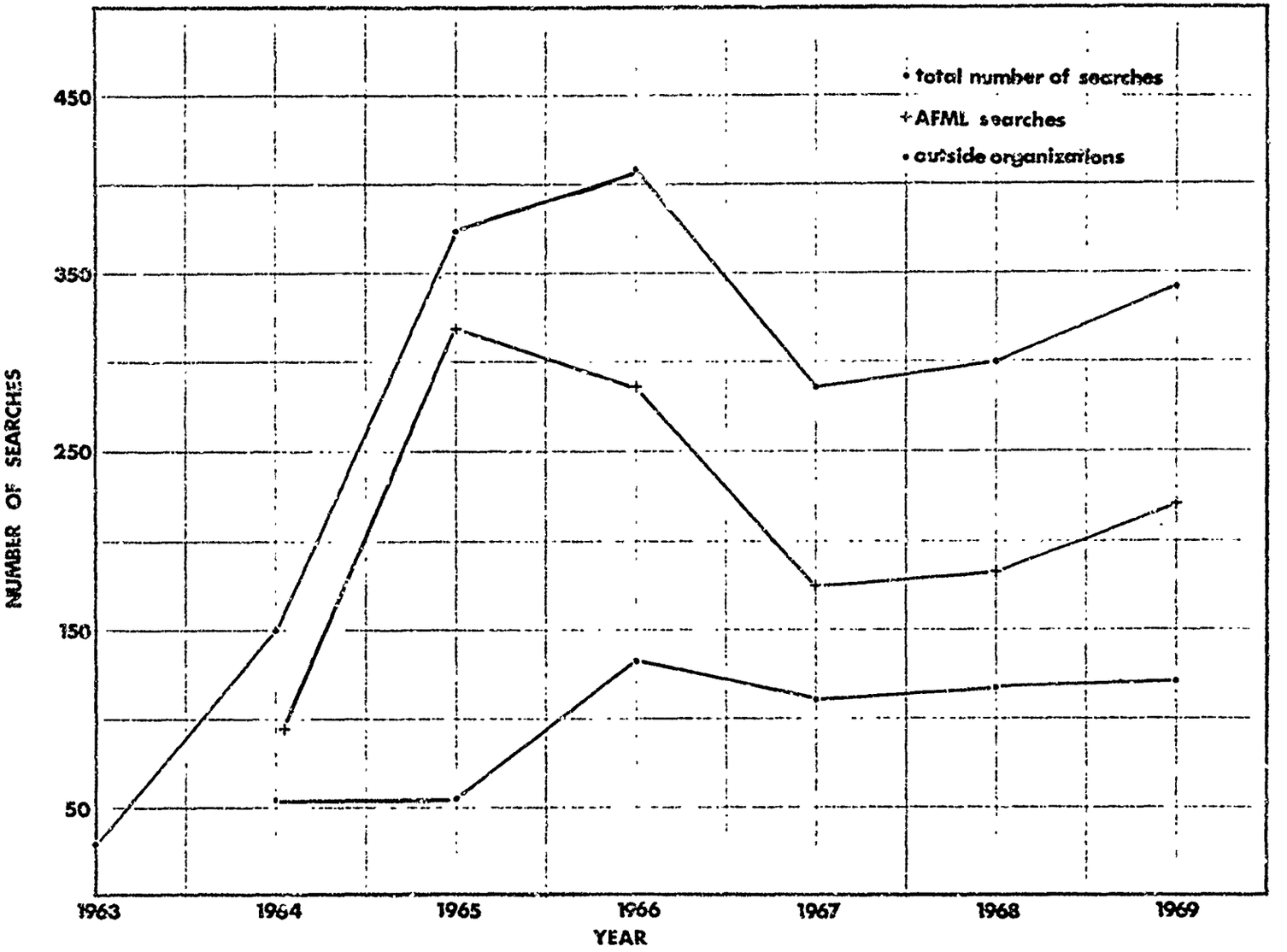


Figure 9 Search Requests Processed 1963-1969

A listing of search requests by subject category is presented in conjunction with a listing of documents input to the system by subject category in Table XIV of Appendix II. A comparison of the two lists indicates a reasonable correlation of search requests and documents by subject matter with the possible exception that the acquisition of physics documents is considerably higher than the user demand. The distribution by subject category of documents of interest as determined from the evaluation study is also presented in Table XIV. The indication from these figures is that greater efforts should be made in acquiring documents in engineering and manufacturing technology and in the area of composites. It is noted that with respect to interest, there is also a deficiency in reports acquired in the area of composites, ceramics, graphites, and plastics. However, there are information centers in existence or planned for each of these material areas which do or will efficiently cover these fields.

A new search strategy technique has been devised using the present Boolean AND, OR, NOT logic by which additional information can be provided about the groups of documents retrieved. One of the restrictions of the previously used strategy is that the terms listed at the beginning of a search have to be present as index terms for subsequent retrievals to occur with other index terms. Furthermore, it was not possible to identify uniquely which terms actually caused the retrieval to occur, or, if more than one retrieval term was present. The new search strategy permits exactly this type distribution of access number "hits" among groups which can be identified.

To illustrate the capability of the new search strategy, four terms - FUEL CELLS, MEMBRANES, ELECTROLYTES, PERMEABILITY are considered. It is assumed that the terms are listed in order of importance, that the most pertinent documents would contain all four terms, and that, if any one of the four appeared, the corresponding access numbers should be retrieved and printed for possible screening. Using the new search strategy, all possible combinations of terms can be allowed for and potentially fifteen identifiable groups could be listed as shown in Table XI. By adjusting the search cut-off appropriately, one can use the search strategy as a "filter" e.g., only those documents which contain at least two terms could be selected for retrieval. It is also possible to apply the same strategy to groups of terms as well as to individual terms. The new strategy is particularly useful when the expected output of documents is rather large. When the expected number of documents is small, the extra effort required for the new strategy is not commensurate with the results obtained. With a small number of documents retrieved, the probability of obtaining "hits" with all or even most term combinations as indicated in Table XI is quite small. Furthermore, one would usually want to retrieve and screen all documents if the number retrieved is small.

TABLE XI DISTRIBUTION OF RETRIEVED DOCUMENTS BY SPECIFIC TERMS AND TERM COMBINATIONS

GROUPS	NO. TERMS OUT OF 4	FUEL CELLS	MEMBRANES	ELECTRO-LYTES	PERME-ABILITY
Group 1	4	X	X	X	X
Group 2	3	X	X	X	
Group 3	3	X	X		X
Group 4	3	X		X	X
Group 5	3		X	X	X
Group 6	2	X	X		
Group 7	2	X		X	
Group 8	2	X			X
Group 9	2		X	X	
Group 10	2		X		X
Group 11	2			X	X
Group 12	1	X			
Group 13	1		X		
Group 14	1			X	
Group 15	1				X

Because of the bulk of the search tape, and the quantity of the update data, it appeared reasonable to divide the data on the search tape into two tapes. The document record data was divided according to the date of issue of the documents. The active search tape contains documents from 1 JAN 64 to the present, and the reserve search tape contains documents issued prior to 1 JAN 64. The majority of searches are run with only the search tape of recent documents, but both search tapes can be run as required. Two searches were selected and run both with the entire tape and with only the more recent tape. Comparison runs were made for Searches 1600 and 1601. For these two searches, which were run as one batch of two searches, the entire tape containing all documents in the system was run, and the new tape containing only documents since 1 JAN 64 was run. Data obtained show that the computer time for running the entire type was almost twice the time required for the new tape. The computer cost was $30.47 for the entire tape and $17.11 for the recent tape. The total number of documents retrieved indicated that the more recent documents tended to be more pertinent to the search request. Twenty-two relevant documents were found from the entire tape, and eighteen were found from the new tape only. Thus for these two searches, significant savings were effected in computer run time and in search screening time with very little loss of relevant documents by running only the tape of documents since 1 JAN 64. Furthermore, the more recent material is usually of highest interest.

3. THESAURUS

A thesaurus updating was made during the reporting period. Several additions were made to the thesaurus and vocabulary as described in Section II, 5 in response to needs indicated from the evaluation study. New terms were added as shown to be necessary from indexing and searching, and certain infrequently used terms were purged from the system.

A further division of the thesaurus was performed to display all the organic fragments used in the U.D. fragmentation scheme for handling organic compounds in a separate listing. The thesaurus is fully separated into three sections - general terminology, metallic materials terminology and organic chemical fragments. Indexers varied in their opinions regarding the degree of separation, some persons preferring only the metallic materials separated, some preferring only the organic chemical fragments separated, and some desiring the complete separation into three sections. A simple program has been prepared which permits the thesaurus to be printed in any of the alternative formats described above. With next printing, "custom thesauri" will be provided according to the preference of the individual.

The concept of a collection term has been expanded. Previously, collection terms had served to collect all terms containing energy, all terms

containing effect, etc. The new concept provides rather broad topics as the collection terms with complete listings of terms related to those topics. An example of such a collection term is shown in Table XII. It should be noted that for terms under the collection term which themselves have narrower term listings, the note "also see narrower term listing under this term" is added.

Further, terms which may be used in more than one sense are designated with the note "these terms are not limited to this topic heading, but may also be used in different conceptual ways depending on the context." A further addition to the thesaurus is the term "collection term" which lists all the individual collection terms. These new items enhance the usefulness of the thesaurus, particularly for new indexer trainees.

4. CHEMICAL ABSTRACTS SERVICE

The University has continued its subscription to the Chemical Abstracts Service, Polymer Science and Technology (POST-P and POST-J) and CA Condensates SDI Services for the benefit of personnel in the AFML. These services have been provided by CAS with the actual search runs being made on a service charge basis.

It was desired to develop local capability for running the SDI profiles against the CAS source tapes. Efforts were made to convert the Chemical Abstracts search programs for use on the University's newly acquired RCA Spectra 70/46. It was anticipated that the University could process these searches at a lower cost than that which CAS was charging for this service. Furthermore, the project was an excellent vehicle to achieve familiarity with the new computer. A preliminary investigation was performed to determine if other CAS subscribers had attempted such a conversion. It was discovered that the University was pioneering in this endeavor.

The initial software installed with the Spectra 70 was limited to an Operating System (OS) of a lower level than that for which the search programs were originally designed. Attempts to by-pass these problems were thwarted by the realization that a massive redesign of the CAS programs would be necessary.

In February, the installation of the Spectra 70's Time Sharing Operating System (TSOS) took place. The TSOS software is more compatible with the CAS programs. However, not much progress was made in the ensuing month due to hardware malfunctions.

TABLE XII COLLECTION TERM DISPLAYING ALL TERMS CONCERNING ELECTRICAL COMPONENTS

ELECTRICAL COMPONENTS - ALSO SEE ELECTRONICS		
ANODES	0361000	
BATTERIES	0471000	
*CABLES	0731500	
*CABLE TERMINALS	0731000	
CATHODES	0819000	
*COILS	1016000	
DRY CELLS	1296500	
ELECTRICAL CIRCUITS	1334500	
ELECTRICAL CONDUCTORS	1336000	
ELECTRICAL GENERATORS	1338000	
ELECTRICAL MOTORS	1339000	
ELECTROCHEMICAL CELLS	1342000	
ELECTRODES	1343000	
ELECTRICAL FILAMENTS	1337900	
ELECTRONIC COMPONENTS	1354500	- Also see narrower term listing under this term
*LOOPS	2167000	
*PULSES	3353000	
SWITCHES	3939500	
VOLTAGE REGULATORS	4549500	
*WIRES	4594500	

*These terms are not limited to this topic heading, but may also be used in different conceptual ways depending on the context.

April and May were spent resolving discrepancies between the IBM 360 and RCA Spectra 70 software which were allegedly compatible. Among the incompatibility problems are the means of handling of magnetic tape labels and standard sort routines. One particular item dealing with the opening and closing of tape files was proven to be a malfunction of RCA software. The problem was documented and submitted to RCA authorities. However, before the response was returned, an updated version (Release 3) of the operating system was installed on the University's computer on June 2nd and the malfunction had been corrected. It was only days later that the CAS programs were running.

The cost analysis of running the CAS programs on the Spectra 70 proved the costs to be prohibitive. A search costing $44 at the University could be run by CAS for $18. It was recognized that the University's cost could be substantially reduced by program refinement, but not to a level to be competitive with CAS.

On September 26, a trip was made to the CAS in Columbus to discuss the price discrepancy, the proprietary nature of the CAS data and their long-term plans for retrospective searching. Among other things learned, it was discovered that CAS planned to raise their computer prices for servicing searches from $165/hr to $240/hr. This increase would allow U.D. to be competitive, and the project was reinitiated in November.

5. ESTABLISHMENT OF A SELECTIVE DISSEMINATION OF INFORMATION (SDI) PROGRAM FOR AFML PERSONNEL

It was determined by the Materials Information Branch that a current awareness service for AFML technical personnel would be useful. Key individuals who expressed a real interest in such a program were selected first and search profiles were prepared for them. In a number of cases Branch Chiefs submitted a single profile covering their entire group.

The new input to the retrospective search tape of the AMIC system serves as the data source for the SDI output. The normal search tape update procedures result in a tape of the new data in the same format as the search tape. Therefore it is a simple matter to run the SDI searches using the same procedures as for retrospective searches. A new SDI run is made every time an update is made; the access numbers are printed out and corresponding abstract copies are prepared and forwarded to the requestor automatically. This program has been in effect since 1 JUL 69. As of 30 NOV 69, 108 SDI profiles had been established.

6. PERSONNEL TIME DISTRIBUTION

Time spent by personnel on the contract is assigned to categories designated by task numbers to indicate the type of activity in which the persons are engaged. From these data a cost distribution by type of activity can be made. The task numbers are defined in Figure 10. The distribution by task number is shown in Table XIII.

FIGURE 10

DEFINITION OF TASK NUMBERS

01	General	Includes:
		Supervision
		Meeting & trips
		Holidays & sick leave
		Writing of reports
		Training of students
		Time spent with visitors
02	Input	Includes:
		Assignment of accession numbers
		Document accounting records
		Preparation of index and abstract cards
		Indexing
		Keypunching
03	Output	Includes:
		Preparation of search strategy
		Search
		Screening of searches
		Search accounting records
		Library loan functions
		Keypunching
04	Updating	Includes:
		Review of vocabulary and thesaurus
		Changes or additions to previous records
		Keypunching
		Acquisition of missing documents
05	(UD) Research	Includes:
		Evaluation studies
		Studies of new techniques
		Investigation of new systems

FIGURE 10 (Cont'd)

05	(AFML) Library	Includes: Preparation of Materials Information Bulletin
06	Special Projects	Includes: Work performed in support of the AFML not directly related to AMIC retrieval system
07	Microfilming	Includes: Time spent on the microfilming of index/ abstract records
08	SDI	Includes: Preparation of SDI profiles SDI records Keypunching Photocopying of abstracts Distribution of abstracts

TABLE XIII DISTRIBUTION OF PERSONNEL TIME BY TASK NUMBER

Professional and Clerical at UD

Task Number	Percent of time
01	20.1
02	46.9
03	10.0
04	7.5
05	1.8
06	12.1
07	0.1
08	1.1

Clerical at the AFMI Library

Task Number	Percent of time
01	9.7
02	57.6
03	4.3
04	9.9
05	14.5
06	3.6

SECTION IV

SUMMARY

An evaluation study was performed for the Aerospace Materials Information Center document retrieval system. Both system performance and economic criteria were established as gauges for evaluation. Particular care was taken regarding economic considerations, and the difficulties and dangers of misuse of economic data were pointed out. Analysis of responses to the standard AMIC search evaluation form indicated that the AMIC system compares favorably with other information centers. To elicit more detailed user feedback, an evaluation form was designed and approximately four hundred requestors were selected. Costs were examined from the standpoint of distribution of costs by activity and the variation in costs over a four year time period.

Results of the evaluation indicated that there is a wide interest in special types of documents as well as the technical reports. State-of-the-art, symposium proceedings, bibliographies, handbooks, trade literature and computer programs were indicated as being of high interest. Many of these special types are now included in the AMIC system as a result.

A number of respondents were unclear as to the services and functions of the AMIC and the relationship of the University of Dayton to the Air Force Materials Laboratory. Also some were not sure how to evaluate the search returns nor, in some cases, were they aware that documents were available on loan or for retention in microfiche form from the AFML library. In response to this need, the University prepared two forms describing how to evaluate the abstracts and explaining the AMIC organization and services. These forms are now sent out with each search request.

A number of respondents indicated a high degree of interest in SDI, but only about 15 percent were actually participating in an SDI program. Results from this part of the evaluation form were especially useful in guiding the initiation of an SDI program for AFML personnel.

Most of the respondents are engaged in applied development/technical work. Surprisingly, few indicated that they work in basic research. In correlation to this finding, the subject categories of interest were very much oriented to mechanical engineering, metallurgy, chemistry, and testing and evaluation.

The respondents indicated a fairly high dependence on information services, both within their own organization and outside information services. Less than half regularly perform their own literature searches. The Defense Metals Information Center, Chemical Abstracts, DDC Group Announcement Bulletin, NASA SCAN and the organization STINFO office or corporate equivalent were listed most often as sources for literature services.

Cost figures for the past four years show that by far the major cost item is the input of documents into the system. The average cost per document including all clerical and professional effort and overhead has averaged about $10 per item for each of the four years while the number of documents indexed per year has doubled from 1966 through 1969. The use of students as indexers has been a significant factor in increasing output while holding costs nearly level.

The cost of searches has varied from $33 to $49 per search including computer time, professional time and clerical time and overhead. Much of the variation in cost can be attributed to the degree of batching of searches. Much greater efficiency is achieved with greater numbers of searches run at once. It could be expected that search costs would increase on a cost/search basis with time since the file length increases and the number of retrievals would tend to increase. However, the batching factor has a highly significant effect. Generally, one can state that the more searches run in a contract year, the more efficient the search operation tends to be as reflected in the cost/search figures.

Certain modifications were incorporated into the AMIC system, primarily in response to respondents to the evaluation form. New types of documents were entered, descriptive forms were designed and are being sent and new vocabulary and thesaurus terms were added. Input to the system was 7100 documents, and 342 technical requests were processed. In-house search capability was attained with the Chemical Abstracts current awareness tapes by converting the search programs to the University's RCA Spectra 70/46. An SDI program for AFML scientists and engineers based on update data to the AMIC search file was initiated.

APPENDIX I

SUBJECT AREA OF WORK OF REPONDENTS

1. Design of nuclear weapons
2. Peaceful use of nuclear explosives
3. Thermonuclear control and applications
4. Elastomers, coatings
5. Textile machinery textile - design engineering
6. Technical information specialist
7. Aerospace structures
8. Elastomeric materials
9. Mechanical engineering
10. Environmental cracking in metals
11. Fracture
12. ECM advanced development
13. Coatings to reduce friction and wear of sliding surfaces
14. Applied statistics and probability
15. R&D apparatus for science and engineering
16. Chemical materials (propellants) - process establishment
17. Solid film lubricants
18. Alloy development
19. Applying techniques of manufacturing technology to epitaxial growth, process control systems with electron beam devices
20. Joining of metals: brazing, welding, diffusion bonding; boron tape composites
21. High temperature resins - adhesive bonding
22. Optical emission, flame emission, atomic absorption, atomic fluorescence spectroscopy
23. Materials applications
24. Elastomers and related materials
25. Engineering data and application problems of metals
26. Thermal protection, ablation
27. Characterization of macromolecules: ultracentrifugation, light scattering, molecular spectroscopy, pycnometry, viscometry; physical behavior of polymers
28. Metals processing: control of variables, microstructure
29. Organic photochemistry
30. Fabricating hollow ball bearings
31. Textiles
32. Chemistry, lubrication engineering
33. Friction and wear studies
34. Thermal optics
35. X-ray spectroscopy
36. Inorganic chemistry, analytical chemistry of ceramics
37. Refractory high temperature materials: ceramics, graphites
38. Machining, machine tool application, fabrication, industrial engineering

39. Materials for jet engines
40. Metal matrix composites
41. Ceramic matrix composites
42. Planning
43. Nondestructive testing
44. Organic chemistry
45. Coatings
46. Application of modern welding techniques to the fabrication of piping systems
47. Rubber chemistry and technology: elastomers and coatings
48. Environmental engineering corrosion control coatings
49. Space and missile systems - materials engineering
50. Chemistry, physics
51. Materials application development testing and evaluation (ceramics)
52. Materials R&D and management
53. Acoustic and aerospace applications of metal fatigue
54. Atmosphere control: provision of oxygen and removal of contaminants from breathing oxygen supply in aircraft and spacecraft, explore physical, chemical, electrochemical or other ways for gas separation
55. Design of nuclear explosive devices, controlled thermonuclear reactions, effects of radiation in the atomsphere
56. Advanced materials, carbon fiber technology
57. High temperature materials research
58. Scientific and technical information services for chemical and metallurgical development and applications
59. Analytical infrared and Raman spectroscopy
60. Flight loads, aircraft fatigue, instrumentation, data collection and processing
61. Materials testing and evaluation
62. Design of structural sandwich panels
63. Development of manufacturing processes, solid state technology (electronics)
64. Heat transfer and fluid dynamics in nuclear reactors
65. Corrosion
66. Development of coatings to prevent fretting corrosion of titanium
67. Structural reliability of fatigue-sensitive aerospace structures: metals, ceramics
68. Thermophysics - thermal transport properties of materials
69. Rain and dust erosion of aerospace materials
70. Electronic materials
71. Fluids and lubricants
72. Structural adhesive bonding
73. Physical chemistry (metals)
74. Reinforced composites for aerospace applications: adhesives, polymers, elastomers, fibers, composites, coatings
75. Mechanical testing of all types of materials
76. Evaluation of the effects of cure on mechanical properties of glass-reinforced resin matrix composites
77. Materials (composites)
78. Papers: battery tape and heat paper

79. Rocket solid propulsion systems, composite materials, microelastic materials, ordanance systems: cartridges, gun propellants, projectiles, warheads, fuses, initiators, explosives; aerospace structures
80. Materials and process engineering
81. Propellers, aircraft accessories, space life support systems
82. Manufacturing research
83. Applied mechanics
84. Boron-printed circuitry, composites
85. Metallurgy
86. Optics
87. Plastics and plastic-based composites - technology and application
88. Composite materials (metal matrix)
89. Thermal/optical properties
90. Technical information retrieval
91. High temperature ceramic material (biological materials for internal prostheti cs)
92. Materials engineering - new systems and problem solving
93. Materials R&D, aerospace engineering
94. Chemistry, physics, metallurgy
95. Missiles, gas turbines
96. Solid state joining of materials
97. Technecal Library engineering
98. Metallurgy : solidification, casting, processing
99. Welding, brazing
100. Mechanical metallurgy (aircraft structural materials)
101. Solid state technology : integrated circuits, hardware, memory systems
102. Materials evaluation
103. Physical and mechanical metallurgy
104. Analytical chemistry (NMR)
105. Development of high strength steels
106. Rocket propulsion materials
107. Metallurgy
108. Metallurgy
109. Materials information handbooks, information storage
110. Corrosion, plating, environmental testing
111. Synthesis and evaluation of advanced fluids and lubricants.
112. Basic processes and metal working
113. Magnetic materials
114. Composites - speckfic work in preparing and evaluating control materials
115. Propellants effect on metals, space technology (design of rocket nozzle on "Eagle")
116. Materials research
117. Graphite evaluation
118. Metals engineering
119. Survival equipment : armor, flares, restraint systems
120. Chemical engineering
121. Technical processes of coatings for repair and retrofit, passivation, diffusion, organic and plastic coatings

122. Thin films, thin film materials
123. Lasers
124. Improved packaging-humidity control sensors
125. Cryogenic coating and thermal control-aerospace
126. Engineering evaluation, value engineering
127. Fuels: lubrication, hazards
128. Mechanical engineering materials: behavior, fatigue
129. Air vehicle dynamics: vibration, shock, acoustics, flutter, loads
130. Materials compatibility
131. Automatic check-out equipment, computer programs
132. Thermal and chemical physics
133. Composite materials
134. Alloy development: metallurgy, high strength metals
135. Nondestructive testing-physics
136. Multidimensional reinforcements, aerospace applications
137. Fiber optics-R&D testing
138. Plastics research
139. Materials Engineering
140. Chemistry, Photochemisty, liquid crystals
141. Geology (shock deformation)
142. Manufacturing, engineering application, engineering technology
143. Mechanical engineering, high powered airborne electronic equipment
144. Process engineering - special machinery manufacturing
145. Thermal properties, thermodynamics of materials
146. Elastomers
147. Casting, forging, metal work ability
148. Mechanical properties, Engineering & Design data
149. Chemical engineering & materials development
150. Materials science & engineering
151. Ablative heat shield development, antenna windows, structural filaments
152. Mechanical behavior of materials
153. Electrodeposition of hard chromium
154. Standards engineer and component specialist-electronics
155. Fluids and lubricants, additives, chemistry
156. Fuel cells, materials research
157. Metal forming component fabrication
158. Structural plastics elastomers (thermoset and thermoplastic), gaskets, seals, couplings, coatings, adhesives
159. Structural adhesives, adhesives
160. Textiles, man-made fibers, polymers
161. Structural adhesives, adhesion
162. All aerospace applications
163. Propulsion systems: air breathing and air augmented rockets, nuclear reactors integrated with propulsion devices
164. Basic research, theoretical chemistry, applied polymer synthesis, separation methods
165. Protective coatings, corrosion control, materials engineering

166. Behavior of metallic materials
167. Reinforced plastics, composite materials
168. Materials, aircraft construction
169. Hot isostatic pressing
170. Nonmetallic material - chemical processes, pilot plant methods, manufacturing
171. Metallurgy and ceramics
172. Developmental work in metallurgical processing
173. Organic photochemistry
174. Instabilities in the plastic flow of high strength steels
175. Process engineering in printed circuit board shop

APPENDIX II

SUBJECT CATEGORIES

AMIC	COSATI	CATEGORY
01	01	Aeronautics
		Aerodynamics
		Aeronautics
		Aircraft
		Aircraft flight control and instrumentation
		Jet engines
02	03+04	Astronomy, Astrophysics, Atmospheric Sciences
		Astronomy
		Astrophysics
		Atmospheric physics
		Meteorology
03	06+07	Chemistry, Biology, Medical Sciences
		Biochemistry
		Bioengineering
		Biology
		Chemical analysis
		Chemical engineering
		Inorganic chemistry
		Life support systems
		Organic chemistry
		Physical chemistry
		Radiochemistry
		Toxicology

AMIC	COSATI	CATEGORY
04	09	Electronics and Electrical Engineering
		Components
		Electronic & electrical engineering
		Telemetry
05	11A	Adhesives
		Ceramic cements
		Organic resin adhesives
		Potting compounds
06	11A	Seals, Sealants
		Ceramic-metal bonds
		Mechanical seals
		O-rings
07	11B	Ceramics, Refractories, Glasses, Minerals
		Borides
		Carbides
		Carbon, graphites
		Mixed oxides
		Nitrides
		Single oxides
08	11C	Coating, Paints, Oxide Films
09	11D	Composites Materials, Laminates, Sandwich Structures, Honeycomb
10	11E	Fibers, Textiles, Cloth
11	11F	Metallurgy, Metallography
		Alloys
		Metals
12	11H	Oils, Lubricants, Heat Transfer Fluids, Greases, Hydrauiic Fluids
13	11I	Polymers, Plastics

AMIC	COSATI	CATEGORY
14	11J	Elastomers
15	11K	Cleaning Compounds, Surface Active Agents
16	11L	Wood and Paper Products
17	21	Fuels, Propellants, Propulsion Systems, Explosives
18	13	Mechanical, Industrial, Civil and Marine Engineering
		Civil engineering
		Construction equipment, materials, supplies
		Containers and packaging
		Coupling, fittings, fasteners, joints
		Industrial processes
		Machining, tools, machine elements such as bearings, gas lubrication systems
		Marine engineering
		Pumps, filters, pipes, fittings, tubing, and valves
		Safety engineering
		Structural engineering
19	14	Methods and Equipment
		Apparatus
		Detectors
		Laboratories, test facilities, and test equipment
		Recording devices
20	18	Nuclear Science and Technology
		Fuel elements; fuel, nuclear
		Nuclear explosions
		Nuclear power plants

AMIC	COSATI	CATEGORY
20 (Con't)	18	Nuclear reactors
		Radiation shielding
		Radioactive wastes
21	20	Physics
		Acoustics
		Crystallography
		Electricity and magnetism
		Fluid mechanics
		Masers and lasers
		Optics
		Particle accelerators
		Particle physics
		Plasma physics
		Quantum theory
		Solid mechanics
		Solid-state physics
		Spectrometry, spectroscopy
		Thermodynamics
		Wave propagation
22	10, 16, 22	Space Technology and missiles
		Astronautics
		Energy conversion, solar cells
		Launch vehicles
		Missile technology
		Re-entry vehicles
		Rockets
		Satellites, artificial
		Spacecraft
		Trajectories and re-entry

TABLE XIV DOCUMENT INPUT, SEARCHES PROCESSED AND RESPONDENTS' INTEREST BY SUBJECT CATEGORY

AMIC CATEGORY	DOCS	SEARCHES	DOCS %	SEARCHES %	RESPOND. %
01	125	25	1.4	5.9	3.5
02	50	4	0.6	1.0	0.4
03	953	27	11.0	6.4	9.5
04	153	23	1.8	5.4	4.3
05	46	16	0.5	3.8	2.2
06	32	4	0.4	1.0	0.4
07	206	32	2.4	7.6	3.9
08	149	12	1.7	2.9	5.2
09	187	42	2.2	10.0	5.6
10	98	6	1.1	1.4	2.6
11	1745	73	20.2	17.6	12.1
12	220	6	2.5	1.4	2.2
13	233	23	2.7	5.4	3.5
14	42	7	0.5	1.7	3.0
15	6	3	0.1	0.7	0.0
16	6	1	0.1	0.2	0.4
17	95	4	0.1	1.0	3.0
18	562	36	6.5	8.6	16.0
19	366	17	4.2	4.0	7.8
20	536	1	6.2	0.2	2.6
21	2439	44	28.2	10.5	5.6
22	198	14	2.3	3.3	6.1

APPENDIX III

EXPLANATORY MATERIALS SENT WITH SEARCH REQUEST RESULTS

ABSTRACTS FROM AMIC SEARCHES

Evaluation: To evaluate the abstracts, please consider certain characteristics of the AMIC system.

1. The AMIC system is primarily concerned with materials or components which are of present or potential aerospace interest.

2. Generally, only the file of documents issued since 1964 is searched. Specific time periods of interest by year may be designated. The file of documents previous to 1964 is searched if requested.

3. Searches can be designed to include or exclude certain types of documents.
   a. Handbook H
   b. State-of-the-Art SA
   c. Symposium S
   d. Bibliography B

   Computer programs, foreign translations, AFML in-house, or AFML sponsored documents may be specified.

4. Abstracts are screened by an information specialist. The relative merit of an abstract to the request is as follows:
   O - not pertinent
   X - possibly pertinent
   ✓ - probably pertinent

5. If search results are found to be unsatisfactory, we will be happy to restructure and rerun the request.

Contingencies:

1. If there are many retrievals and many probably pertinent documents, only ✓ documents are returned.

2. If there is a moderate number of retrievals ✓ abstracts and sometimes X abstracts are returned.

3. If there is a low number of retrievals, both ✓ and X abstracts are returned.

4. If there are no retrievals, this indicates either that there is little work reported in the area or that the request is not suitable for our system (non-materials). In the former case, the search verifies the need for research.

Philosophy: The screening of abstracts is not highly restrictive. It is preferred to risk sending nonpertinent material than to risk not sending pertinent abstracts. If the number of retrievals is low, abstracts of low pertinence may be forwarded to indicate the best capability of the AMIC system for that request and to permit the requestor to make judgment.

Acquisition: Documents and additional abstracts may be obtained on loan or permanently as available from:

AFML Library; Bldg. 17 (MAAM)
W-PAFB Area B
Dayton, Ohio 45433
Phone: AC 513/255-5197

The Aerospace Materials Information Center (AMIC)

The Aerospace Materials Information Center is a joint project of the Air Force Materials Laboratory (AFML) and the University of Dayton Research Institute (UDRI). The AMIC is one of seven specialized information and data centers which constitute the Air Force Materials Information Centers (AFMIC). The UDRI is specifically responsible for the document processing and retrieval functions of the AMIC.

The AMIC system contains documents which deal with some aspect of materials or components of aerospace interest. The documents are usually technical reports generated in-house (work done at the AFML at W-PAFB) by contractors (AFML sponsored) and reports from other military services or government or civilian organizations such as NASA, AEC, university reports, etc. Translated foreign documents, computer programs, journal article reprints, theses, bibliographies, state-of-the-art reports, symposia, handbooks are special items included.

Retrospective search requests are formulated into an appropriate search strategy depending on the search request requirements. A wide range of flexibility in search strategy formulation is available, with regard to the specificity of material designation, environmental conditions, type or report, and other factors. For example, one can specify the class of superalloys at a certain temperature range with gas turbine exhaust gases as the environment. On the other hand, one could request all information on Rene' 41. One could further specify only handbooks and state-of-the-art type reports for Rene' 41 with foreign translations excluded. One can specify AFML in-house and/or AFML sponsored reports. In addition to temperature ranges, frequency ranges, pressure ranges and energy ranges can be specified as required. Retrospective searches are normally made only to the search tape which represents documents issued since 1 JAN 64. As requested, the tape for documents prior to 1964 is also run.

Any person working for the U.S. Air Force or on USAF contract is eligible for the services of the AMIC at no charge. Elapsed time from receipt of a request to return of results is normally five days to two weeks, but more rapid response can be provided in special cases. The abstracts of retrievals are screened for pertinence before they are forwarded to the requestor. Original documents to which the abstracts refer are maintained at the library at AFML and are usually available on loan. The point of contact for the AMIC is:

Mr. Harold B. Thompson
AFML (MAAM)
Wright-Patterson AFB, Ohio 45433
Phone: Area Code 513 - 255-2160 or 255-5177

Some representative types and topics of information included in the AMIC system are:

Ablation/Heat transfer/Thermal protection
Aircraft/Aeronautics, with search capabilities for specific aircraft or specific aerospace vehicle components.
Adhesives
Astrophysics
Ceramics, with emphasis on and search capabilities for specific cermets, glasses, and refractories.
Chemistry, with emphasis on inorganic compounds, chemical complexes, organometallic compounds and crystal chemistry.
Cleaning Agents/Solvents/Surface active agents
Coatings
Composites, including fabrication, micromechanics and testing techniques.
Computers/Computer Programs, with emphasis on computer and statistical methods applied to physio-chemical phenomena, analytical and manufacturing processes.
Elastomers
Electronics/Semiconductors
Engineering, including chemical, civil, electronic/electrical, industrial, marine, and mechanical engineering topics.
Fibers/Textiles
Fuels/Propellants
Geo-Sciences/Minerology/Meteorology
Lubricants/Hydraulic fluids/Bearings
Materials Research
Manufacturing Technology, including tooling and fabrication methods.
Metals/Alloys
Nuclear Science and Technology/Nucleonics/Particle Physics
Paper/Wood
Physics, with emphasis on solid state, radiation, and plasma physics.
Polymers, with emphasis on the synthesis of polymer intermediates to final fabrication techniques.
Seals
Space/Missile/Re-entry Technology, with search capabilities for specific space projects or programs.
Structures (theory-design-fabrication)
Testing Methods/Instrumentation/Analytical Methods/Measurement techniques
Theoretical studies

APPENDIX IV

SEARCH REQUESTS PROCESSED
1 DECEMBER 1968 - 30 NOVEMBER 1969

SEARCH NO.	SEARCH TITLE
1477	High Temperature Elastomers
1478	Friction Materials for Aircraft Brakes
1479	Cracking of D6AC Steel
1480	Thermopoxy for Space Testing
1481	Thermal Properties vs. Temperature--Various Materials
1482	Field Emission in Films
1483	Aluminum Oxide Dielectric Films
1484	Electroluminescents
1485	Polarization in Electrets
1486	Ferroelectrics
1487	Photochromics
1488	Updating Bicyclo Bi-Terms, etc.
1489	Updating C and E Terms
1490	Electrochromism
1491	Surface Attack Titanium Alloy
1492	Creep Forming
1493	Rockets Fuels, Oxiders, C. M.
1494	Beryllium Foil
1495	Pressure--All Documents of 1967
1496	Metals Melting Points 1967
1497	Thesaurus Update Word Check
1498	Machinability of Ceramics
1499	Filaments Update--Fibers

1500	Electrical Filaments
1501	Thesaurus Update
1502	Debye Temperature of Zn, Se, ZnTe
1503	X-Ray Data High Temperature Behavior of Rare Earth Oxides
1504	Hot Sizing Titanium Alloys
1505	Deep Hardening Titanium Alloy
1506	Pollution from Points
1507	Pressure Transducers
1508	Thesaurus Update #5
1509	Boron Phosphides
1510	Thesaurus Update "Pressure"
1511	Galvanizing--Manufacturing Technology
1512	C Fibers from Polyacrylonitrile
1513	Thesaurus Update #7
1514	Metal Coatings for Stainless Steel/Tungsten Adherends
1515	Vapor Deposition of Metals on Stainless Steel/Tungsten
1516	Apparatus for Compression Testing NOL Rings
1517	Thesaurus Update #8
1518	Thesaurus Update #9
1519	Gas Chromatographic Analysis of Acrylic Fibers Pyrolysis Products
1520	Re-entry Vehicle Transpiration Coding--Not Ablation
1521	Re-entry Vehicle Transpiration Coding--And Ablation
1522	Thesaurus Update #10
1523	Aeroplastic Properties, Tests of Composites
1524	Thesaurus Update #11
1525	Recent Developments in Ceramics, Cermets
1526	Stripping Vegetable Oils
1527	Thesaurus Update #12

1528	Thesaurus Update #13
1529	Maintenance--Word Check
1530	Thesaurus Update #14
1531	Pressure Effect--Updating
1532	Thesaurus Update #15
1533	Thesaurus Update #16
1534	Thesaurus Update #17
1535	Thesaurus Update #18
1536	Thesaurus Update #19
1537	Thesaurus Update #20
1538	Thesaurus Update #21
1539	Thesaurus Update #22
1540	Thesaurus Update #23
1541	Thesaurus Update #24
1542	Thesaurus Update #25
1543	Thesaurus Update--Final
1544	Additives to Elastomers
1545	Exposure Effect on Aluminum Protective Coatings
1546	Bulk Boron Processing Melting
1547	Fuel Cells--State of the Art
1548	Thesaurus Update #26
1549	Thesaurus Update #27
1550	Integrated Circuits
1551	Compatibility in Boron Reinforced Aluminum Composites
1552	Deep Hole Drilling
1553	Sealing Transistors with Glass Lids
1554	Neutron Radiography
1555	S-N 7079-T6 Forging

1556	Electron Beam Welding of Copper
1557	Rare Earth Metallurgy
1558	Update Supplement #1
1559	Pressure Measurement
1560	Ablation of Composites
1561	Boron, Carbon Composites
1562	Composites in Aircraft
1563	Adhesive Bonding of Aircrafts
1564	Diffusion Bonding Structures
1565	Partial Pressure Update 1969
1566	Charge, Separation in Fracture
1567	Update Supplement #2
1568	Update Supplement #3
1569	Update Supplement #4
1570	Update Supplement #5
1571	Human Remains
1572	Atmospheric Corrosion of Metal
1573	Update Supplement #6
1574	Refractory Alloy Superalloy Foils
1575	Electrodeposition Organic Coatings
1576	Radiation Hardening Aluminum
1577	Particle Size Equipment
1578	Solid Dry Lubricants on Stainless Steel and Aluminum
1579	Air-Conditioning and Ventilation of Subs
1580	Temperature Effect on Steel H-11
1581	Osmosis/Osmometry Search
1582	Cemented Carbides Check
1583	Salt Check

1584	Laser Damage
1585	Theoretical Analysis of Composite Behavior
1586	High Temperature Thermal Insulation
1587	Mechanical Behavior of Metal Composites
1588	Protective Coatings for Component Storage
1589	Protective Coatings for Storage--Nonmetal
1590	Reinforcement--Matrix Compatibility in Metal Composites
1591	Update Supplement #7
1592	Update Supplement #8
1593	Preparation of Boron Fibers
1594	Glass Reinforced Thermoplastics
1595	Metals -- Update 1
1596	Information on Fluoro-Carbons
1597	Metals -- Update 2
1598	Stress Corrosion of Aluminum 7075, 7175
1599	Silicon Nitrode Matrix Composites
1600	Metals -- Update 3
1601	Ceramic Matrix Composites
1602	Ultraviolet Radiation Protection for Fibers, Cloth
1603	Ultraviolet Radiation Inhibitors
1604	Pseudo Isotropic Fabrics
1605	Flammability of Textile Materials
1606	Three-Dimensional Fabric Weaving
1607	Carbon, Graphite Fiber Formation
1608	Catalysis of Graphitization
1609	Oxidation, Decomposition of Polyacrylonitrile
1610	Electrical Resistivity of Carbon and Graphite Fibers
1611	Thermal Radiation, Mechanical Properties of Fibrous Materials

1612	Heat Transfer Coefficient of Polymers
1613	Properties of Fibrous Materials at Subambient Temperature
1614	Fiber Properties at High Strain Rate
1615	Radar Properties Fibers Chaff
1616	Optical Glass -- High Refractive Index and Visible Light Transmission
1617	Non-Fluorine Optical Glasses of Low Refractive Index
1618	Formation of Inorganic Whiskers
1619	High Tenacity, High Modulus Fiber
1620	Fiberization of Nonmelting, Nonsoluble Polymers
1621	Dispersion and Precipitation Hardening of Chromium Alloys
1622	Pressure Measurement Update
1623	Vapor Deposition for Filaments
1624	Processing, Properties of Aluminum, Titanium Composites
1625	Fabrication of Heat Resistant Polymer Composites
1626	Joining Nonmetallic Composites
1627	Structure and Environment Space
1628	Photo- and Thermochromic Non-Destructive Testing
1629	Re-entry Effect on Ablative Plastic Composites
1630	Metals Update 4
1631	Metals Update 5
1632	Metals Update 6
1633	Metals Update 7
1634	Update Final
1635	Drawing Dispersion Precipitation Hardened Wires
1636	Climatic Exposure Test, Protection
1637	Flammability of Hydraulic Fluids
1638	Lubrication in Space
1639	Electrohydrodynamic Pumping

1640	Ammeline/Dimethylsulfoxide Reaction Products
1641	Perfluoroalkyl Triazines
1642	Water Contamination of Hydraulic Fluids
1643	High Pressure Viscosity Studies
1644	Bulk Modulus of Oils, Hydraulic Fluids
1645	Elastohydrodynamics
1646	Fluorinated Ethylene-Propylene Powders
1647	Shear Effect on Fluids
1648	Preparation Testing of Dry Film Lubricants
1649	Friction, Wear Mechanisms of Linear Polymers
1650	Laser Triggered Light
1651	Laser Spectra from Solutions
1652	Transparent Coatings, Manufacturing Technology
1653	Adhesion of Electrodeposited Coatings
1654	High Temperature Fuel Tank Sealants
1655	Self-Sealing Fuel Tanks, Lines
1656	Hydraulic Ram Effects
1657	High Temperature Aircraft Tire Performance
1658	Aircraft Tire Performance vs. Construction
1659	Rocket Propellant Expulsion Bladders
1660	Surface Activated Fillers for Elastomers
1661	Cancelled--Classified Subject Matter
1662	Electrostatics in Aircraft
1663	Spacecraft Thermal Design
1664	Thermal Control Coatings
1665	Degradation of Paints
1666	Thermal Protective Coatings
1667	Adhesive-Bonded Aerospace Components

1668	Ballistic Impact Phenomena
1669	High Performance Thermoplastics
1670	Amide-Imide Copolymers and Polyimides
1671	Transparent Plastics for Structure
1672	Electrical Conductive Plastics
1673	Structure and Properties of Titanium--Beryllium Compounds
1674	Phase Equilibria of Titanium--Beryllium System
1675	Service Failures of Aircraft
1676	Microstructure Effect on Mechanical Properties of Graphites
1677	Structural Adhesives Honeycomb Structure
1678	Surface Treatment of Stainless Steel and Titanium for Adhesive-Bonding
1679	Space Adhesive Bonding Technique
1680	Antioxidants for Adhesives
1681	Impact Strength of Adhesive Bonds
1682	Rapid Curing Techniques for Adhesives
1683	Optical Properties Polymers: Temp. 070
1684	Low Density Ablative Composite Heat Shields
1685	Nonmetallic Composites Antenna Windows
1686	Metal Containing Polymers
1687	Carbon-Carbon Composites
1688	Three-Dimensional Reinforcement Composites
1689	Ablation-Theories, Models, Analysis
1690	Rocket Motor Case Insulation
1691	Dezincification as Corrosion Phenomenon
1692	Diffusion Bonding Beryllium
1693	Shock Effects in Natural Materials (Rocks, Soils)
1694	Wear on Titanium and Alloys
1695	Melting Titanium

1697	Incremental Forging
1698	Ceramic Composite Materials
1699	Nondestructive Testing of Weldment
1700	Zirconium Oxide--Y203 Properties
1701	Nondestructive Testing of Honeycomb
1702	Mechanical Properties of Metal Composites
1703	Interfaces of Metal Composites
1704	Nondestructive Test Detection of Martensite
1705	Properties of Landing Gear Steels
1706	Properties of Maraging Landing Gear
1707	Surface Waves: Acoustic
1708	Mass Spectra, Data System
1709	Lightweight Armor for Aircraft
1710	Plane Wave Propagation in Inhomogeneous Media
1711	Composite Armors
1712	Boron Nitride Antenna Windows
1713	Semiconductor Spinels
1714	Zero Bandgap Alloy Systems
1715	Ferrite Films for RAM
1716	Variable Delay Lines
1717	Rare Earth Intermetallic Compound Magnets
1718	Silicon Carbide Preparation
1719	Isotope Separation
1720	Resin 2 for Antenna Windows
1721	Thermodynamics of Graphites by Ultrasonic Methods
1722	Infrared Sensitive Photochromic Materials
1723	Ultrasonic Nebulization Absorption Spectra
1724	Data X-ray Spectrometer

1725	Barium Sodium Niobate Optical Crystals
1726	NiSb-InSb Infrared Detectors
1727	Three-Dimensional Weaving
1728	Integrated Heat Shield Structures
1729	Radar Absorbing Composites
1730	Polyimide Composite Radomes
1731	Machining Composites
1732	Ion Implantation
1733	Isostatic Pressing of Beryllium
1734	Solid State S Band Oscillators
1735	Production of Single Crystal Spinel
1736	Oxidation of Nonferrous Alloys
1737	Transpiration, Film Cooling
1738	Properties of Titanium-Beryllium
1739	Alloy Effects on Corrosion of Michrome
1740	Resonant Frequency
1741	Properties of Wires
1742	Stress Corrosion of Magnesium Alloys
1743	Stress Corrosion of Titanium Alloy
1744	Magnetic Plated Wire Memories
1745	Electrochemical Machining
1746	Cutters for Biaxial Machining
1747	Automated Nondestructive Testing of Turbine Blades
1748	Automated Cleaning of Turbine Blades
1749	Ultrasonic Machining Optimization
1750	Electrical Discharge Machining
1751	Hollow Ball Bearings
1752	Upgrade Titanium Scrap

1753	20 mm. Aluminum Cartridge Cases
1754	Incremental Hot Stretch Forming Panels
1755	Hydrostatic Forming
1756	Boron Fiber/Titanium Tapes
1757	Cast Titanium Alloy Parts
1758	Rolling Superalloy Sheets
1759	Hot Die Forging of Landing Gear
1760	Process for Cross Rolled Disks
1761	Production of Jet Engine Disks
1762	Strain Age Cracking of Nickel Superalloys
1763	Quartz Single Crystals
1764	Properties of Steels
1765	Acoustical Fatigue of Aircraft
1766	Armor for Russian Tanks
1767	Fretting, Corrosion, Fatigue of Titanium
1768	Erosion, Abrasion, Impact of Titanium Alloys
1769	Shot Peened Aluminum Alloys--Fatigue
1770	Airplane Canapy Coatings
1771	Environment Effect on Optics
1772	Generic Update #1
1773	Generic Correction--Acids
1774	Generic Correction--Coating
1775	Generic Correction--Ceramics
1776	Weld Butt Joint Design
1777	Graphite Properties at High Temperature
1778	Nitroso Copolymer
1779	Correct Mechanical Properties
1780	Generic Correct Metals

1781	Metals Broad Term Correct
1782	Generic Correct Bis
1783	Correct Heat Resistant Polymers
1784	Generic Correct Forming
1785	Generic Correct Fuels
1786	Generic Correct Machining
1787	Generic Correct Light Metals
1788	Generic Correct Light Metal Alloys
1789	Generic Correct--Noble Metals
1790	Generic Correct--Thermoplastics
1791	Generic Correct--Steels
1792	Generic Correct--Working
1793	Welding Lockalloy
1794	Thermal Properties of Pure Metals
1795	Generic Update #5
1796	Generic Correct--Refractory Alloys
1797	Generic Correct--Refractory Metals
1798	Generic Update #4
1799	Generic Correct--Single Oxides
1800	Generic Correct--Transition Metals
1801	Surface Preparation for Adhesive Bonding
1802	Durability Adhesive Bonds to Aggressive Environment
1803	Generic Update #6
1804	Generic Correct--Mixed Oxides
1805	Cure and Temperature Effect on Adhesive Bonds
1806	Mechanisms of Adhesive Bond Degradation
1807	Moisture Resistant Adhesives for Water Craft
1808	3-Dimensional Fabric, Reinforcement

1809	Copper Brazing Alloys--State of the Art Document
1810	Correct Water Craft
1811	2-Fluoro-2, 2-Dinitroethyl Compounds
1812	Plastic Encapsulating Electron Compounds
1813	Generic Correct--P-Metals
1814	Generic Correct--Physical Properties
1815	Generic Correct--Organic Acids
1816	Update Light Metal Alloys
1817	Generic Update #7
1818	Generic Correct--Chemical Reactions
1819	Generic Correct--Polymers
1820	Generic Correct--Organic Salts
1821	Generic Correct--Olefins
1822	Effect of Aviation Fuel Combustion Products on Superalloys
1823	Effect of Aviation Fuel Combustion Products on Compressors
1824	Generic Correct--Metalloid Alloys
1825	Generic Correct--Alloys
1826	Generic Update #8
1827	Generic Correct--Actinide Alloy
1828	Generic Update #9
1829	Manufacturing Technology of Flouronitro Compounds
1830	Viscosity Enhanced Silica
1831	Poissons Ratio--Polymethylmethacrylate
1832	Piezoelectric Effect Voltage Value Range
1833	Differential Thermal Analysis and Thermogravimetric Analysis of Metal Catalysis Liquids
1834	Generic Update #10
1835	Generic Correct--Plastics
1836	Trichloroethylene Cleaning Compound

1837	Southeast Asia Material--Military
1838	Surface Preparation for Adhesive Bonding
1839	Elastic Constants of Orthotropic Composites
1840	Ceramic Composites
1841	Automated Nondestructive Inspection
1842	Aluminum-B Composite Application
1843	Surface Properties
1844	Properties of Iron-Al-Cr Alloys
1845	Ceramic Armor Materials
1846	Computer Programs
1847	Industrial Diamonds, Machining
1848	Nylon High Vacuum and Temperature Stability
1849	Properties of Titanium--Beryllium
1850	Special Categories Check
1851	Word List Date Check
1852	Materials for Transducer
1853	Polymer Modified Ceramic Cement
1854	Acoustic Fatigue of Materials
1855	Strain Measurement by Capacitance
1856	Cracking of Titanium
1857	Hypervelocity Impact
1858	Shock, Impulsive Loading Phenomena
1859	Aircraft Armor Materials--Impact
1860	Structural Composites for Machine Tools
1861	Design, Calibration of Measuring Devices
1862	Dynamic Response to Acoustic Excitation
1863	Vidicon, Orthicon, Storage Display
1864	Properties of PVA, Polypropycene

1865	Nondestructive Testing of Metal Microstructure
1866	Separation of Ultrafine Particles
1867	Emissivity of S_1O_2 Phenolic Composites
1868	Effect of Peening, Abrasive Blast-Defects
1869	Damped Normal Vibration Modes
1870	Cemented Carbides
1871	Wood and Paper Industry
1872	JP Fuels, Nylon, ABS, Fluorocarbon
1873	Stress Analysis of Flat-Bed
1874	Shock-Mitigating Materials
1875	Re-Radiative Coatings, Heat Shields
1876	Permeation Tube
1877	Antenna Moving Apparatus
1878	Piston Failure in Aircraft Engines
1879	In-Service Aging of Elastomers
1880	Oxidation of Alkanes
1881	Fatigue Data Steel 9310
1882	Corrosion Prevention in Water Storage Tanks
1883	Ceramic Additives Effect on Creep
1884	Hydraulic Shock in Radar System
1885	Adhesives for DC Motor Design
1886	Cleaning of Turbine Components
1887	Evaluation of Shot Peening-Materials
1888	Cloud Seeding, Weather Control
1889	Forcefit Electrical Contacts in Transparent Plastics
1890	Stress Relief-Methods, Equipment
1891	Preparation of Zirconium and Yttrium Alkoxides
1892	Aluminum Chloride Dimerization

1893	Kinetics of CO_2, H_2O with Carbon
1894	Composition of Phenolic Composite
1895	Graphites, Carbon Containing Composites
1896	Humidity, Temperature Effect on Aircraft Electrical Systems
1897	Weld Fatigue of Steels
1898	Die Casting of Ferrous Metals
1899	Thermoset Polymers for Cast
1900	Hermetic Seal of Electronic Components
1901	Beta Three Titanium Ti-Mo-Sn-Zr
1902	Kinetics of C and CO_2 Reaction
1903	Bi-, Multiaxial Stress Effect
1904	Cost/Fabrication of Stainless Steel
1905	Properties of Titanium Alloys
1906	Cerium Alloys with Al, Fe, Ti
1907	Isostatic Pressing and Equipment
1908	1-3 Mil Diameter Nonmetallic Monofilaments
1909	Long Term Fatigue of Aircraft Metals
1910	Al 2024, Al 2219 Stress Creep
1911	Fatigue of Magnesium, Magnesium Alloys
1912	State-of-the-Art of Structural Composites
1913	Al 2014-T6 Grain Size, Temperature
1914	Al 2014-T6 Creep, Notch, Temperature 070
1915	Human Toxicity to Thermosets
1916	Ti-Al-V Bonding Boron Composite
1917	Press Fit Die Casting Zinc
1918	Antenna Design

REQUESTOR INDEX

REQUESTOR	COMPANY
Adair, A. M.	MAMN AFML
Allgeyer, G.	Owens Illinois Inc.
Allinikov, S.	MAAE AFML
Anderson, C.	MATP AFML
Anspach, W.	MANE AFML
Aponyi, T.	MANC AFML
Arvay, E. A.	MANC AFML
Asselanis, Maj. G.	Ogden Air Materials Area
Atman, Lt.	MATE AFML
Barta, J.	ARZ-ARL
Bauerle, R.	U of D
Baun, W.	MAYA AFML
Bendure, E.	Martin/Marietta Co.
Berens, A.	U of D
Berner, B.	U of D
Bertke, R.	U of D
Bidwell, Dr. L.	MAMS AFML
Boche, J.	U of D
Boebel, C.	MANE AFML
Bohlen, Lt.	MAMN AFML
Bowen, J.	Martin Co.
Braden, R. C.	Balfour-Stulen
Breland, Capt. J.	MANE AFML
Bright, E.	SGTED
Brisbane, A.	MAMD AFML
Brooks, F.	MANL AFML

Bunting, P. M.	General Dynamics
Burk, J. L.	ASBCS
Canter, 1/Lt. C.	MATE AFML
Caldwells, Mr.	AUWA
Campbell, G.	MATP AFML
Carson, S.	MAYH AFML
Cavanaugh, H.	ASEP
Charlesworth, J.	MAAM AFML
Chasman, B.	MAP AFML
Chattoraj, S.	MAMC AFML
Christian, J.	MANL AFML
Collins, Lt. B.	MAMS AFML
Connell, W.	General Electric Co.
Cosale, Lt.	MAMC AFML
Crawford J.	AFFDL
Creedon, J.	TRW Systems
Crosby, J.	MAMP AFML
Crosby, R.	U of D
Davis, A.	MAC AFML
de Jonckheere, Capt.	AFIT
de Pierre, V.	MAMN AFML
Dimiduk, P.	MAYT AFML
Donlan, V.	MAYE AFML
Doulan, D.	MAYE AFML
Dragoo, R.	General Dynamics
Dueweke, P.	U of D
Duvall, D	U of D
Emerson, Dr. P.	North Carolina State Univ.

Emery, W.	University of Vermont
Emrich, B.	MAAM AFML
Ezekial, H.	MANF AFML
Fearn, F.	Babcock and Wilcox
Fechek, F.	MAC AFML
Fenter, J. R.	MAMC AFML
Ferguson, Maj.	MAAA AFML
Frederick, W.	MAYE AFML
Gabinelli, D.	U of D,
Galley, Lt. R.	MAMN AFML
Garrett, H.	MAYE AFML
Gehatia, Dr. M.	MANP AFML
Geyer, N. M.	MAMP AFML
Glenn, G.	MATP AFML
Gloor, W.	MANF AFML
Goodwin, P. M.	Air Systems Command
Gowan, Lt.	AFFDL--FDDS
Graham, T.	MANE AFML
Gregory, F. H.	Aberdeen Proving Grounds
Griffith, G. H.	MAYH AFML
Hall, J.	MAMP AFML
Halpin, J.	MANE AFML
Hasz, J.	Cincinnati Milling Machine Company
Haynes, 2/Lt. G.	FTD-TDPTN
Henderson, J.	MAMD AFML
Hendricks, P.	MAMP AFML
Hentrich, R.	U of D
Hickmott, R. L.	MAYE AFML

Holten, A.	ASNFS-30
Houston, J.	Bendix Corp.
Husman, Mr.	MAC AFML
Hyler, W.	Battelle Memorial Institute
Inouye, S.	MAMN AFML
Jaffee, E. H.	MAC AFML
Johnson, H.	MATP AFML
Johnson, L.	Boeing Corp.
Kajute L.	Olin Research
Katkic, E.	ASNAE-40
Kelley, L.	MAC AFML
Kennard, R.	MATP AFML
Kershaw, Maj. J. P.	MAMS AFML
Kibley, Lt. E.	MAMD AFML
Kluge, A.	U of D
Kramar, J.	U of D
Krebs, N.	Rennselear Polytechnic Institute
Krentz, D.	DuPont
Kulp, B.	Elgin AFB
Lai, R.	Cable Brundy
Lawless, B.	U of D
Leeson, J.	Bendix Corp.
Lefebvre, R.	Brown Engineering
Litchaur, F.	Curtiss Wright
Litvak, S.	MATF AFML
Lombard, C.	MAAA AFML
Lopez, G.	SGTED
Love K.	MATF AFML

Loving, Capt. E.	MANL AFML
Lyon, S.	MAMS AFML
Mahieu, W.	U of D
Manoff, M.	MANC AFML
March, J.	U of D
Marler, L.	Tinker AFB
Marolo, S.	MANC AFML
Marshall, Lt. J.	MANC AFML
Materne, H.	MANC AFML
May, J. Jr.	Small Business Administration
Mazdigasni, K.	MAMC AFML
McConnell, B.	MANL AFML
Metzgen, Dr. G.	MAMP AFML
Meyer, F.	MAAA AFML
Meyerer, Capt. W.	Ohio State University
Middendorp, H. J.	MAMP AFML
Middleton, R.	AMMRC
Mildrum, M.	U of D
Miller, E.	MATE AFML
Miller, F.	MATF AFML
Miller, G.	APIP-1
Minges, M.	MAAS AFML
Minnis, C.	U of D
Moore, Lt.	MAMS AFML
Morrissey, E.	MAAE AFML
Muntz, J.	MAYA AFML
Murray, K.	MANE AFML
Murtaugh, J.	U of D
Nietubiez, C.	U of D

O'Hara, W.	MATP AFML
Opt, P.	MAT AFML
Ornstein, P.	MAAA AFML
Owens, F.	MAN AFML
Pacinda, G.	U of D
Panton, D.	Beech Aircraft
Pasick, J.	MATF AFML
Pass, M.	Alumicraft Corp.
Paul, J. Jr.	Hercules Inc.
Paulson, A.	ASNMS
Petrak, J.	U of D
Picklesimer, L.	MANF AFML
Polishuk, P.	AFFDL
Polley, L.	MATP AFML
Proto, G.	National Security Agency
Rapson, Capt.	MAC AFML
Reimann, Dr. W. H.	MAMD AFML
Reinhart, T.	MAAE AFML
Rice, Lt. D.	MAMS AFML
Riche, R. P.	Globe Industries
Rigaud, Mr.	University of Montreal
Riley, R.	U of D
Roddy, R.	Sperry Flight System Division
Rondeau, R.	MAYH AFML
Rowand, R. R.	MAMN AFML
Rubenstein, S.	General Electric Co.
Rubin, B.	MANL AFML
Rubin, B.	General Electric Co.

Rutner, Dr. E.	MAYT AFML
Sandman, R.	Cincinnati Milling Machine Co.
Scheffler, F.	U of D
Schmidt, D. L.	MANC AFML
Schulman, S.	MANF AFML
Schultz, C.	U of D
Schulz, Capt. W.	MAC AFML
Schwartz, H.	MANE AFML
Schwenker, H.	MANL AFML
Selvaggio, F.	SGMEO
Shimmin, K.	MAMD AFML
Shinn, D.	MAAA AFML
Shipp, Col.	Mag-1
Sieron, J.	MANE AFML
Smithson, L.D.	MAYA AFML
Snyder, C.	MANL AFML
Snyder, J.	MATF AFML
Spencer, A.	Bendix Corp.
Stanton, Lt. R.	MANF AFML
Starks, D.	MATP AFML
Stevens, H. L.	MAMN AFML
Stevenson, D.	MAYT AFML
Stout, R.	MANE AFML
Syms, B.	North American Rockwell
Tarrants, E.	MATE AFML
Tesson, Lt.	MAAS AFML
Thomas, E.	SGTED
Tolle, A.	FDDA

Tolley, Lt.	MANC AFML
Tompkins, L. V.	Piasecki Aircraft
Tressler, R.	MAMS AFML
Trickett, G.	MATP AFML
Tupper, N.	U of D
Tupper, N.	MAAA AFML
Turpin, W.	U of D
Van Patten, R.	AMRL
Voltz, J. F.	Industrial Services Directorate
Walbury, T.	MATC AFML
Weaver, J.	MANE AFML
Weiss, V.	Syracuse University
West, B.	U of D
West, M. G.	MAC AFML
Whitford, D.	U of D
Wiegand, V.	SGMES-20
Wieser, L.	MANL AFML
Williams, M.	Utah University
Winters, D.	U of D
Work, R.	North Carolina State Univ.
Yoder, G.	MAAA AFML
Young, G.	Hercules Inc.
Zawilinski, M.	U of D
Zoeller, H.	MAA AFML

INDEX OF REQUESTING ORGANIZATIONS

COMPANY	NUMBER OF SEARCHES
Aberdeen Proving Grounds	1
AFFDL-FDDS	3
AFIT	1
AFML	221
Air Systems Command	1
Alumicraft	1
AMMRC	1
AMRL	1
APIP-1	1
ARZ-ARL	2
ASBCS	1
ASEP	1
ASNAE-40	1
ASNFS-30	2
ASNMS	1
AUWA	1
Babcock and Wilcox	1
Balfour-Stulen	1
Battelle Memorial Institute	1
Beech Aircraft	1
Bendix Corporation	4
Boeing Corporation	1
Brown Engineering	1
Cable Brundy	1

Cincinnati Milling Machine Co.	2
Curtiss Wright	1
DuPont	1
Elgin AFB	1
FDDA	1
FTD-TDPTN	1
General Dynamics	2
General Electric Co.	3
Globe Industries	1
Hercules Inc.	2
Industrial Services Directorate	1
Mag-1	1
Martin Co.	1
Martin/Marietta Co.	1
National Security Agency	7
North American Rockwell	1
North Carclina State University	2
Ogden Air Materials Area	1
Ohio State University	1
Olin Research	6
Owens Illinois Inc.	2
Piasecki Aircraft	1
Rennselear Polytechnic Institute	1
SGMEO	1
SGMES-20	1
SGTED	4
Small Business Administration	1
Sperry Flight Dynamics Division	1

Syracuse University	1
Tinker AFB	1
TRW Systems	1
University of Dayton	134
University of Montreal	1
University of Vermont	2
Utah University	1
Total Number of Searches for this period:	441*

*Includes Information System check searches

REFERENCES

1. E. A. Janning, Establishment of a Coordinate Indexing Retrieval System for the Air Force Materials Laboratory, RTE-TDR-63-4263 Air Force Materials Laboratory, W-PAFB, Ohio, November 1963. (AD 428 423)

2. E. A. Janning, The Modification of an Information Retrieval System by Improving Vocabulary Control, Indexing Consistency, and Search Capabilities, AFML-TR-65-20, Air Force Materials Laboratory W-PAFB, Ohio, March 1965. (AD 613 301)

3. E. A. Janning, Operations of a Document Retrieval System Using a Controlled Vocabulary, AFML-TR-66-36, Air Force Materials Laboratory W-PAFB, March 1966. (AD 633 614)

4. F. L. Scheffler, Student Indexer Training Program and the Improved Operation of a Document Retrieval System, AFML-TR-66-391, Air Force Materials Laboratory, W-PAFB, Ohio, January 1967. (AD 651 039)

5. F. L. Scheffler, Indexer Performance Analysis and Operations of a Document Retrieval System, AFML-TR-67-379, Air Force Materials Laboratory, W-PAFB, Ohio, February 1968.

6. F. L. Scheffler, Document Retrieval System Operations Including the Use of Michrofiche and the Formulation of a Computer Aided Indexing Concept, AFML-TR-68-367, Air Force Materials Laboratory, W-PAFB, Ohio, February 1969.

7. R. J. Penner, "The Practice of Charging Users for Information Service: A State of the Art report," Journal of the American Society for Information Sciences, vol. 21, #1, Jan. - Feb. 1970, pp. 67-73

8. "Charges for Services and Products" American Society for Information Science 32nd Annual Meeting, Hilton Hotel, San Francisco, California, 3 October 1969.

9. J. Maranchik, Jr., Fourth Annual Report of the Air Force Machinability Data Center, AFMDC 68-6, Metcut Research Associates, Inc., Cincinnati, Ohio, October 1968.

10. P. Fasana and J. Fail, "Processing Costs for Science Monographs in the Columbia University Libraries;" Library Resources & Technical Services, Vol. 11, #1, winter 1967, pp. 97-114

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
University of Dayton Research Institute Dayton, Ohio	UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

USER APPRAISAL AND COST ANALYSIS OF THE AEROSPACE MATERIALS INFORMATION CENTER

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Summary Report, 1 December 1968 - 30 November 1969

5. AUTHOR(S) (First name, middle initial, last name)

Scheffler, Frederic L.
March, Jacqueline F.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
January 1970	94	10

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
F33615-69-C-1128 b. PROJECT NO. 7381 c. d.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) AFML-TR-70-27

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Air Force Materials Lab., (MAAM) Wright-Patterson AFB, Ohio 45433

13. ABSTRACT

An evaluation study was performed for the Aerospace Materials Information Center document retrieval system. Both system performance and economic criteria were established. Analysis of responses indicated that the AMIC system compares favorably with other information centers with regard to providing pertinent materials with a sufficiently rapid response. Results showed a wide interest in special types of documents as well as the technical reports. State-of-the-art, symposium proceedings, bibliographies, handbooks, trade literature and computer programs were indicated as being of high interest. The respondents indicated a fairly high dependence on information services, both within their own organization and outside information services. Cost figures for the past four years show that by far the major cost item is the input of documents into the system. The average cost per document including all clerical and professional effort and overhead has averaged about $10 per item. The cost of searches has varied from $33 to $49 per search including computer time, professional time and clerical time and overhead. Much of the variation in cost can be attributed to the degree of batching of searches. Certain modifications were incorporated into the AMIC system, primarily in response to respondents to the evaluation form.

DD FORM 1 NOV 65 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Aerospace Materials Information Center						
Document Retrieval System						
Cost analysis						
User evaluation						
Users						
Evaluation						
Selective Dissemination of Information						
SDI						
Thesaurus						
Computers						
Indexing						
Information retrieval						
Search structuring						
Operations						
Feedback						
Requestors						
Distribution						
Batching						
Performance						
Economics						
Searching						
Materials information						
Information services						
Information centers						
Input						
Retrospective searching						

Security Classification